THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY AND STATISTICS.

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VOL. III.] CALCUTTA: TUESDAY, 1st JANUARY 1878. [No. 1.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India, at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular, varies so much in the different Provinces, that it is absolutely necessary to give the English value of it, in all cases. It would be a great reform if the Government itself followed the same course, in all the official reports published by it.*

LETTERS TO THE EDITOR.

UNI-ACRE PLANTING.

TO THE EDITOR.

SIR,—I am surprised that no one has taken up his pen against this home,—this [illegible] scheme,—but perhaps it has been considered as not worth the trouble [illegible]

[illegible]

MADRAS AGRICULTURAL COLLEGE.

SIR,—With reference to a paragraph that appeared in your November issue, I have the honor to point out that the Madras Agricultural College is open to candidates from all parts of British India. It is not from any unwillingness on my part, that more candidates have not been accepted. We have as many students as the limited means at my disposal justifies. When we have more accommodation, we shall be glad to receive candidates from Bengal. Of the students now at the College, nearly one-third are from different parts of the Bombay Presidency.

SYDAPET, WILLIAM R. ROBERTSON.

30th November 1877. Supdt. Govt. Farms, Madras.

MANGOLD WURZEL.

SIR,—In the last Report of the Lucknow Horticultural Garden, shewing the working for the year ending 31st March 1877, I find among other very interesting information that Dr. Bonavia raised 385 mds. of mangold wurzel from a plot of land measuring 2,403 square yards, now that was equal to 775 mds. per acre., and as mangold wurzel is largely used at home for stall-feeding of cattle, I should feel obliged by some of your contributors informing me whether this root is easily kept, and if so, how should it be kept. By giving a cow 10 seers a day the quantity raised on an acre, would keep 8 cows the whole year round.

MAC.

GREEN JOWARI AS CATTLE FODDER.

SIR,—With reference to a letter from a correspondent signed "S. Jewanjee." in your last number, I write to say that I quite agree with you that this gentleman has been led astray regarding the "worm" said to be formed on the *Jowari* plant, it is true that caterpillars of moths and butterflies are often met with, but they are perfectly harmless, should cattle ever eat them with the green *Jowari*; it is a popular fallacy which is very general among natives of most parts of India. I have given the subject much attention, and can affirm that the *Soorghum Vulgare*, Tamil *cholum*, Hindoostanee *Jowari*, is rich in saccharine matter before the ear is pushed out, and cattle devour it when they can, rather greedily, without due mastication, and it readily ferments in the paunch of the animal and gives rise to the disease known as *Hove* or *Blown*, and if not soon relieved the animal dies asphyxciated. This fact is so well known among the natives that they take great care to keep cattle from entering *cholum* fields during the season, and when an animal is taken ill they resort to *muntrums* and *poojahs*, suspend *neem* leaves and flowers around the animal's neck and resort to all sorts of ceremony without success. The only sensible practice I have seen natives resort to sometimes, is to get stems of the Mudar plant, the *Calatrophis Gigantea*, and force it down the animal's mouth between the grinders and work it there up and down, till the animal begins to chew its cud, when the gas is expelled and relief frequently obtained, but in most cases immediate relief is given by tapping the paunch with a long trocar and letting out the confined gas, the operation is a simple one, but it requires practical tact to carry it out successfully into practice.

I have alluded to the subject in my "Cattle Manual" page 61, under the head of *Hove, Tympanitis or Blown* to which I would beg to refer your correspondent for further information on the subject.

JOHN SHORTT.

Madras, 20th December 1877.

[illegible]AIZE [illegible]ALKS AS CATTLE FODDER.

SIR,—With reference to the request contained in your issue of November last, I am glad to be able to supplement your foot note regarding the value of maize stalks for fodder. The maize plant is cultivated at Bangalore chiefly as a garden crop, and the cobs sold green, just as the grain begins to harden. The stalks are cut as soon as the cobs are removed, and used largely for cattle food, being then in a mature but green state. Whether they diminish the yield of milk or not, I am unable to say from personal experience, as bullocks alone are kept on this farm, and I doubt the value of the mere hearsay evidence of the bazars.

For instance, it is universally supposed here that perfectly dry maize stalks are useless for fodder, but this is probably due to their never having been kept for the purpose, as during the three hottest months of this year, the twenty pair of bullocks kept on this farm, were fed almost exclusively on this fodder, and were at the expiration of the period in excellent condition. The only other food they had were small quantities of the dried straw of the *Sorghum Saccharatum, Sorghum vulgare* and dried Guinea grass which were given indiscriminately, as all these fodders were stacked in one large stack. The cattle during this period, worked chiefly at carting earth and manure for nine hours daily.

Only a few days since, I noticed a bullock that had broken loose, eating a dry maize stalk two years old, which had become detached and was lying on some first rate grass by the side of the stack. Clearly here hunger was not the cause of the preference.

In America it is, I believe, a frequent custom to turn store cattle into maize fields to find a living on the stalks after the ripe corn has been gathered.

H. HARMAN.

BANGALORE EXPT. FARM,
3rd December, 1877.

PRICKLY COMFREY.

(*To the Editor of the Madras Times.*)

SIR,—I enclose an extract cut from a home Agricultural paper and sent me by a friend. Like many other planters, I have gone in rather extensively for Prickly Comfrey, and although my plants are too young yet for me to attempt to use the leaves as fodder, and hence myself being unable to say anything for or against the plant, I trust the writer of the paragraph has been unduly severe in his abuse, and that the plant will prove useful for fodder.

PRICKLY COMFREY.

[The extract referred to is as follows :—

Prickly Comfrey is one of the most ridiculous of the many small delusions that are perpetually haunting the farms and gardens of this country. It has been for several years freely advertised, frequently lauded, and favourably commented on, and to this day not a word in its praise has come from any man whose word would obtain attention as worthy of trust. It is well spoken of by such as are interested in its diffusion, but those who have tried it fairly condemn it as worthless, or are carefully reticent because ashamed of having swallowed such an uninviting bait. Were it adapted to clothe the desert with nutritious herbage, it would be welcomed as a boon, but it needs good land, it possesses no special feeding properties, and the cattle require to be taught to eat it by the painful process of starvation. It will be grown by many yet, no doubt, for there are always to be found new customers for new things, even if the characters they bear are vague and doubtful. The time is at hand for planting this thing, and we advise such of our readers who lean towards the prickly deceit, to be cautious as to the breadth of land they devote to it, lest it should prick their fingers, and give them grief for gain.

THE PROPERTIES OF TREES.

(*To the Editor of the Bombay Gazette.*)

SIR,—I have read with mixed feelings of pleasure and surprise your article on the properties possessed by trees, which appears in the issue of the 9th instant. With pleasure, because it shows that the question of trees and forests in their relation to climate, rainfall, agriculture, &c, is occupying *at last* a small share of that attention from the public and others, which so very important a question should undoubtedly command; with surprise, because of the views it enunciates. With your permission, I will attempt a reply to the several heads of your article.

In the first place you state, "*we* find so far as our experience goes there is really no evidence to show that a greater quantity of rain falls on a forest, than on open land outside it;" and you remark that you might almost infer from the results of the Bavarian experiments up to 1874 that the effects of forests upon rainfall is *nil*. It would seem that you have not heard of the observations made in France by M. Mathieu, of the Forest School at Nancy, and by M. Fantrat, in this matter.

M. Mathieu established three stations, each with a complete set of instruments, for measuring the rainfall, temperature, and moisture of the atmosphere in the neighbourhood of Nancy; so far back as 1866, since which date observations on these points have been noted down and collated by him—observations, which extending as they do over a series of 11 years, are extremely valuable. One of the stations selected by M. Mathieu is in the middle of the forest of Haye, about five miles from Nancy; a second is just on the border of the forest at "la Belle Fontaine," and about the same distance from Nancy; and the third is at Amance, in an open but moderately wooded, though purely agricultural, district 10 miles from Nancy. The results which M. Mathieu has obtained are singularly uniform, and they have been reproduced so often that even so careful and conscientious an observer as M. Mathieu considers that they may be held to be dependent on a general law of nature. They may be summed up as follows :—

1st. That the mean temperature in a forest is always lower than in an open unwooded tract of country.

2nd. That this difference is less sensible in winter than in summer.

3rd. That in a forest the changes from heat to cold, and *vice versa* operate more slowly.

That the day and night temperature is more nearly alike, also that the change of temperature from one day to another and from one season to another operates less rapidly in a forest than in the open.

That sudden changes of temperature, when they do come, being more gradual, are less felt in the forest than in the open.

And in regard to details—

1st. That throughout the year 6 per cent. more rain falls in the forest than in the open.

2nd. That, of the rain which falls throughout the twelve months of the year, about 10 per cent. is caught by the leaves in a forest and does not reach the earth.

3rd. That the evaporation in the open country is five times as great as in a forest, in consequence of which the soil in a forest, notwithstanding the diminished amount of rain which reaches the earth, retains its freshness and moisture long after that in the open has dried up.

M. Mathieu's observations then lead to the conclusion that while, on the one hand, forests tend to lower the general temperature of a country and so to promote the fall of rain at regular intervals and in moderate quantities, on the other hand, they ward off meteorological changes, which are dangerous, in-as much as they cause sudden and heavy falls of rain, which result in floods and other like disasters.

The observations of M. Fantrat, though extending over a much shorter period of time, have a greater value than even those of M. Mathieu, in regard to the direct action of forests in regulating the temperature through the decomposition and assimilation of carbon and the emission of oxygen in the air. Apprehending that objections might be raised as to the value of M. Mathieu's observations, on the ground of the distance of his stations from each other, as well as of one of them from the forest, M. Fantrat, whose observations were made at Fleurines, in the forest of Halatee, erected his instruments almost close together; one pluviometer was placed 25 feet above the tops of the trees inside the forest, and the other in the open plain, but close to the border of the forest, 250 yards only from the first and at the same height from the ground. During the eight months over which the observations extended 11·80 inches of rain were measured in the pluviometer inside the forest, while only 10·95 inches were measured in the other, which was outside, being an excess in favour of the former of 8 per cent, while the amount of moisture in the air above the forest as compared to that above the plain was 63 to 61.

Furthermore, of the 11·80 inches of rain which were registered in the first pluviometer, only 7·07 or about 60 per cent. reached the ground while at the same time the evaporation was five times as great outside the forest as inside of it. These results being obtained at stations situated so near each other are exceedingly striking, as they tend to prove a considerable direct influence in forests on the amount of the rainfall and moisture.

M. Cantegril, Inspector of Forests at Carcassonne, near Toulouse, in the extreme south of France, also carried out a series of similar observations with pluviometers scattered at different stations over his department (Aube) and *with precisely similar results*.

Here, then, we have proof positive, obtained by careful experiments conducted by learned and competent men that more rain *does* fall inside of a forest than on the open land outside. But apart from these experiments the observations of scientific men in different parts of the world have, years ago, established the fact that trees do influence rainfall.

Surgeon C. J. Smith, of the Mysore Commission, when reporting, on the 23rd June 1849 on the effect of trees on the climate and productivene that it may be successfully grown at a lower elevation than the ordinary coffee, I had enquires made both in Liberia and on the Gold Coast, the result of which was communicated to the Ceylon Government. I extract the following statement from the report from Monrovia, as likely to be of more general interest :—

"The Liberian coffee grows equally well in the immediate neighbourhood of the sea, and at considerable distance from it. Under like conditions of soil and cultivation, trees near the seashore in Monrovia are about the same as those at Careysburg, and other places 30 miles distant. The wild coffee from which the cultivated comes, is found at even still greater distance in the interior. Our nearest trees are 100 yards from the sea. At Bassa and Sinon, we are told, trees grow well still nearer the sea. Lowest temperature observed at Monrovia near the sea 62° Fahrenheit at 7 o'clock in the morning of the month of January, during the prevalence of the Harmattan winds. Highest temperature observed, 91° Fahrenheit. These are exceptional cases. The general temperature ranges from 72 to 87° in the shade. In the interior at the farthest point, where coffee is cultivated by the settlers, there is a difference of one or two degrees lower, owing principally to the rise of the land. Along the coast the coffee tree thrives at only a few feet (say ten) above sea level at Careysburg and at Mount Coffee it succeeds as well at an elevation of 500 feet."

REFORMS IN COFFEE PLANTING.

THE Travancore coffee planter whose letter to the *Madras Times* we noticed in our last issue writes further as follows :—

In my last letter I have made this remark, *viz*., "that the present working in hilly ranges is entirely wrong from beginning to end." An imputation, a serious imputation of this nature, that the present working of the coffee plantations in the hilly ranges of Ceylon and India, is entirely wrong from beginning to end, requires proof, which I am prepared to give for the consideration of the European planting community at large.

If I am not mistaken, the first work done in opening an estate on the hilly ranges (for coffee, or tea or cinchona) is the felling of the forest trees. When the felling is done, there is no work whatever for about two months, and every one awaits the best opportunity to set fire to the felled clearing, so as to obtain, as much as possible, a good burning. Well it is precisely with that good burning that the mischief begins. If a land possesses 3, 4, 5 feet of vegetable soil, we may be allowed to use the economical and expeditive method of clearing by burning. But, to do so on stiff land, possessing no more than from 4 to 6 inches of rich vegetable soil, is more than a mistake, as I shall prove fully.

It is well known that the sub-soil in the hilly ranges of Ceylon and India is a very heavy soil in general, while the vegetable surface soil on the contrary is light—and hence the cause that such light soil is liable to be washed away so easily by the heavy annual rains.

In presence of these two facts, *viz*, a very few inches of rich soil, but light, resting on stiff land, and some time very stiff, are we to manage to make such few inches of rich soil heavier or lighter? Of course, heavier and never lighter! But unfortunately by our stupid burning (in which burning it often occurs that a neighbouring planter burns out his next neighbour) we make the light soil much lighter, and, if there is a strong wind for a few days, at that time, a part of the ashy-soil is carried away. But let the tremendous rains come, and then there is the regular progressive wash of the light soil. Burning the soil is a strong stimulant which, in some cases, enriches the father, but always ruins the son, and, for such reason, burning the soil in modern agriculture is entirely rejected, and, in some places, legally interdicted. For our own common future prospect, the planters, at large, of Ceylon and India, should come to a general understanding for abandoning and stopping at once the disastrous operation of clearing by burning, and adopt some other plan, such as this one, for instance, (or a better one if found by any other interested party) *viz*:—Firstly, the underwood of the clearing should be cut down, so as to clear the way as much as possible. All the underwood which can be used as pegs for marking holing, and afterwards the holes themselves, should be kept in bundles, here and there, on the clearing itself, for future use. All the underwood which can be used for the building of coolies' lines, cattle sheds, temporary *bungalows* and buildings, should be taken out of the clearing and brought to such or such proposed spot. When the underwood is entirely cleared, there remain only the large jungle or forest trees to be cut down. Secondly, immediately the large trees are cut down, all the branches should be cut—so as to procure more pegs and more materials for temporary buildings. Valuable trees will be sawed and sold as timber for railways or general buildings, and common trees converted into planks and sold for making packing-boxes for coffee, indigo, &c. Now will such a method of clearing, which does away entirely with burning, cost more than the actual doing? It is only by a fair practical trial that we can arrive at a positive Yes or No.

But in the absence of a proof by trial, we can all consider the point and come to this conclusion, *viz*: should the cost be more, or even much more, it is nothing if we can avoid the murderous burning; but, Mr. Editor, I am fully of opinion that the cost will not be much more, and for many estates having at their command a decent road, or water carriage, or situated at twenty miles from a Railway line, the sale of the timber and planks will pay very likely the felling expenses, and give besides a certain profit to be utilized on further operations.

For the estates, having not the advantages of carriage above mentioned, the advantageous sale of such valuable timber is an impossibility for the present; then we must patiently keep that valuable timber in our own estate, until 10 or 20 neighbouring estates can one day unite together to get a cheap tramway of their own to go and join the fair main road. Several splendid systems of cheap tramway are in working all over the world, even amongst the planters of India! But perhaps we are poor? Poor? No, because for years many planters have expended plenty of money, but unfortunately in a wrong way of doing, and hence poor and no success, and hence discouragement! Indeed, how can we find [illegible] of [illegible] ten or twenty to start a tramway, when, [illegible] every direction round us, in our own estates, we are [illegible] with the cry of terror and distress: "Leaf disease" again!

What is the use of having tramway, railway, splendid roads, &c., if we have not plenty of coffee, but a very poor crop to bring down. To bring up rice and provisions to the estates, as well as manure, &c., and to bring down coffee, there is no doubt that proper carriage way is a very important point, but the most important point is to avoid entirely the sickness on tapping and surface roots and to have good regular crop.

Well, Mr. Editor, I think that I have sufficiently proved that the very beginning (clearing by burning) is monstrously wrong.

Then what is next after burning? Lining. Lining for drains and holes is the only thing with which there is no fault to be found. Then next is [illegible] which is [illegible] badly and is one of the causes of "root disease," and hence all the success or ruination, for some lose having not sufficient capital to manure heavily and expensively, and some profit having capital and buying cheaply some estates and manuring them heavily. Of course, that is business, *viz*., "With money we make money"! and "without money we cannot make money"! Indeed it is with plenty manure that, in every cultivation, large crops are obtained, but in rotation of culture; rotation however, is impossible in coffee, tea and cinchona cultivation; when once planted, the plantation should stand for not less than sixty years or seventy years, and then abandon the land and allow it to take full rest for not less than thirty years, and even fifty years if possible, and it can be done if a person possesses sufficient land.

I have to state a great many things more, but written statements on paper are not practical proofs on stiff land, in the hilly ranges of India and Ceylon. Often scientifically written statements and proposals are failures in practice, therefore I am of opinion that it is far better to have a practical proof than to write much about it.

I am scientifically ready to come forward as a competitor for the prizes offered. I say prizes, for it will be proper to have several, because from the conception of the *modus operandi* of those obtaining, for instance, prize No. 1, prize No 2 and prize No. 3, we may come to a final combined mixture of the three modes of working into one, which will be the future guidance for present and new settlers.

Indeed, nothing is more encouraging in investing capital, than to have a sure direction which has been fully and triumphantly proved and accepted by the whole community interested in the question. As one so interested I will be very glad if my plan of improvements is superseded by a better one. In such a case I shall not exclaim "I am defeated," but I shall exclaim "I am a gainer as well as the whole planters' community of India and Ceylon." I now leave the question in your hand, Mr. Editor, as well as in the hand of the Indian and Ceylon press, to be discussed for the general interest.

CEYLON BOTANICAL GARDENS.

THE annual report on these Gardens for 1876-77 has been published and contains some interesting particulars regarding the successful introduction of new products. The prospects of Liberian coffee are encouraging from the tenor of Mr. Thwaites remarks on the subject. He says :—

The Liberian coffee is being warmly taken up, and many are obtaining seeds from Liberia in some considerable quantity, for sowing in the warmer parts of the Island. There can be no doubt of this valuable plant succeeding here, judging from the admirable replies received from residents in Liberia in answer to a series of questions drawn up by me, at the desire of His Excellency the Governor, and forwarded through the Colonial and Foreign Offices. Some of the older plants in this Garden, received from Kew and from Mr. Bull, three years ago, have recently produced a small crop of ripe berries, a fine blossom at the same time giving promise of a large crop of fruit next year. It seems that a year must elapse between each successive crop. A certain number of our plants have been reserved for putting into the new tropical garden at Henaratgoda, a portion of which is being cleared and fenced for the purpose. A few plants, one or two to each, have been distributed through the Government Agents to intelligent headmen in some of the hotter districts of the Island. Having experienced disappointment in instances of the seeds of Liberian coffee having been sent to me in a too dry state, and hence having lost their vitality, I must caution intending importers against the adoption of this plan. The seeds intended for transmission from Liberia, I would recommend to be allowed to get fairly dry under an open shed and by no means to be exposed to the sun during the process; that they should then be packed in alternating layers of sandy soil nearly dry, indeed only just sufficiently moist to prevent further desication of the seeds, and yet not moist enough to cause them to germinate during their transmission in ordinary strong, close cases."

Mr. Thwaites has no fresh information to give us respecting the coffee leaf disease, although he refers to the confidence inspired by the beneficial effects of judicious manuring. As respects cinchona, Mr. Thwaites has most satisfactory progress to report: 1 196,000 young plants were distributed from Hakgala during 1876, but success had not yet attended the many attempts to propagate rapidly from cuttings, plants of *C, Calisaya* which have still to be raised from seeds. Out of a case containing 185 plants of the most valuable kind (*Ledgeriana*), sent from the Bandong Plantation by the Governor-General of Java to Sir William Gregory, only six plants were saved from the effects of bad packing, and these do not promise well. For cinnamon, the Director reports a continued large demand for plants and seed, no doubt from European planters in the Central Province, who are filling up abandoned coffee land and other patches of light soil in the lower districts with this plant. From Peradeniya, 12,000 plants and 18 bushels of seed were distributed last year. Respecting "cocoa" and other new products, we have the following paragraphs:—

CHOCOLATE.—The demand is increasing for seeds and plants, and it is to be regretted that we have not yet larger supplies for distribution. Our new plantings, however, are coming on satisfactorily, and will in due time yield us as many seeds as we are likely to require. Among the new plants coming on, are some of the Caracas variety presented to the garden by R. J. Corbet, Esq., a few years ago. A seed pod of a highly esteemed variety was recently obligingly sent me by Mr. W. Nelson, a large planter resident in Guatemala but unfortunately the pod was sent in a dry package, and therefore arrived in a state unfit for sowing. The seeds of chocolate, unless put in a position to germinate, lose their vitality in a few hours after being gathered from the tree.

TEA plantations are rapidly making themselves visible in the upper portions of many of the hills of the Central Provinces. The shrubs exhibit a very healthy appearance. The Assam Hybrid variety is in most favor for planting, and there is very little demand for the ordinary Chinese kind.

CARDAMOMS are being still planted extensively.

BLACK PEPPER.—There has not been much demand during the past year.

VANILLA.—Very few plants have been sent out. The native villagers show no disposition to pay attention to this plant, which would give them very little trouble to cultivate.

IPECACUANHA.—No one has come forward to cultivate this plant seriously as a profitable undertaking, and I have only to report an increase in the number of our plants ready for distribution.

CAOUTCHOUC.—From Kew I have received some hundreds of young seedling plants of *Hevea brasiliensis* and a few plants of *Castilloa elastica*. These were contained in 39 wardian cases and arrived by the S. S. "*Duke of Devonshire*" in excellent condition, under the care of Mr. W. Chapman, sent by the India Office in charge of them. These valuable plants, with the exception of comparatively few failures, remain in excellent health, and I hope to be able to carry out the wishes of the Indian Government in supplying in due time a number of young plants raised by cuttings from these, for transmission to Burmah for the formation of plantations in that country. Most of the plants are kept at present in bamboo pots, for the convenience of their removal to the new tropical garden at Henaratgoda when preparations are fully made and suitable weather arrives for sending them thither. Although they are growing well in the climate of Peradeniya, still it may be expected that the warmer climate of Henaratgoda, little above sea level will better correspond with that of Panama, whence these plants were brought.

From the India Office have also been sent to me a few seeds of the Ceara rubber plant for trial here.

From seeds obligingly procured for me from Assam by Dr. King of Calcutta, we have succeeded in raising a few plants of *Ficus elastica*.

SHADE AND SHELTER TREES.—A very large number of these have been sent out and a copious supply is always kept on hand to meet the now very frequent demands for them. They are kept mostly in bamboo pots for easy transmission to estates where they are required; 34,000 plants have been supplied, besides large quantities of seeds.

CINCHONA CULTURE IN JAVA.

THE official report on the cinchona culture in Java for the 3rd quarter of 1877 contains the following particulars of a most unfavourable season for the young cinchona plantations in that island.

"The three months of the past quarter were characterised by extraordinary dry weather. At most of the establishments no rain whatever fell—at some of them, from 1 to 2 rainy days were noted during the whole of that period. Owing to the dry weather and the very clear nights the temperature often fell to 60° C. and on two occasions even night frost was noticed, so that in the morning the grass and the woodwork of the bridges were covered with hoar frost. The larger plants have not suffered from the long drought, but among the younger ones very great mortality has arisen therefrom which will make replanting on a grand scale necessary during the approaching west monsoon. Night frost has damaged a number of young plants at three of the establishments—It may, however, be expected that most of these will recover. Another result of the long drought has been that from cleared land where the superfluous wood, &c., was being burned, the fire, owing to a high East wind reached the neighbouring cinchona plants, although as much care as possible had been taken to prevent it. The dried grass and weeds that lay amongst the cinchona trees and the remains of former forest trees formed so many inflammable materials that it often required the utmost exertion to check the flames, particularly at two of the establishments. Yet people could not prevent an area of about 5 *bows* of the cinchona-plantations from suffering so much from the fire, that the trees being on the point of dying off were dug up in order at least not to lose the bark. Want of labourers especially caused by the compulsory labour of the people on the coffee estates continued to the end of August. There has however since been a sufficient supply of labourers. By free labourers 22,127 daily services have been performed. After the harvest had ended, the work done consisted of the laying out of fresh plantations, the improvement of those from which the crop had been gathered, and the digging of holes for the plants to be put into the prepared ground during the approaching west monsoon. At the close of August, when the Hemiptera which occasions the cinchona rust began to be scarce, and only a very few young specimens showed themselves, the trees on the plantations affected were pruned and the prunings burned. During September, a large quantity of seeds of *C. Officinalis* was forwarded to private persons. Application for seed are continually increasing as is to be expected, now that the favourable results which have for several years been obtained from this variety of cinchona are becoming more extensively known."

During the quarter, harvesting operations were concluded: 63.220 Amsterdam pounds of cinchona bark are being forwarded to the Netherlands for sale, and 3,130 Amsterdam pounds are being set apart for the medical service in Netherland India. About 7 000 Amsterdam pounds of bark were lying ready for shipment. On the 18th July last, 34 chests and 154 bales of cinchona bark of the 1876 crop were sold by auction at Amsterdam, the highest price brought being 3 23 *guilders* per ½ *kilo* of *C. Officinalis*.

ADVERTISEMENTS.

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NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India, at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular, varies so much in the different Provinces, that it is absolutely necessary to give the English value of it, in all cases. It would be a great reform if the Government itself followed the same course, in all the official reports published by it.*

LETTERS TO THE EDITOR.

PARAFFIN OIL FOR SEEDS.

TO THE EDITOR.

SIR,—Your journal at Page 218, August 1876, recommends steeping seeds in *Paraffin oil* for a night to stimulate growth. Page 402; December 1877, recommends the same, but says " add a wine glassful of oil to 80 gallons water, mix, settle, skim off oil and empty the water are the seeds, then, to be soaked in the oil or the water, and how long ?

I am trying various seeds in plain oil, also in saltpetre solution, *viz* : maize, *reana luxurians* and coffee, and will let you know the results.

P. HUNTER BLAIR.

NOTE.—The seed should be soaked in the oil for a night, and the water used for irrigation.—ED, *I. A.*

ARBORICULTURE AND MANURE.

SIR,—The peace and quietness given to the country by British rule has no doubt been one cause of famine, and will continue so, until the soil is manured sufficiently, to enable it to meet the pressure of the population upon it. This cannot be done while the people make use of the manure for fuel, instead of returning it to the ground, to enable it to yield its proper returns. Until fuel is brought within reach of the people, there will be no manure. In the neighbourhood of every Indian village, there is a large extent of waste ground on which nothing will grow, by reason of the continual cropping, and walking over of the village cattle. Begin then, by enclosing one third of this waste, and sowing it with the seed of trees that are indigenous to the neighbourhood. In 6 or 7 years, the trees then having attained sufficient growth, it may be thrown open to the village cattle for grazing purposes. Treat the second-third, in the same way, and at the end of another 7 years, the remaining third. In this way, an enormous area of country would soon be brought under arborescent cultivation. The cost to Government, beyond the salaries of a few " Inspectors of Village Plantations," should be *nil*, as the villagers should be required to erect the fences in the lull of agricultural operations, their reward being liberty to cut the wood hereafter for their domestic purposes free of cost ; a royalty only being demanded in the event of the wood being sold for brick, or lime-burning, or other purposes. As soon as the fence was erected, the villagers could in turn give a daily look round to see that cattle did not stray in, and the herdsmen should be fined, if they allowed any of their cattle to trespass.

As an aid to agriculture, irrigation of course has its value, but it is not so necessary or so much wanted, as manure Irrigation will make the ground yield more for a few years, but if no manure has been given, it will cease to be productive, and will go to *reh*, and become useless for any purpose. I believe that *reh* is caused by the exhaustion of the soil from over-cropping and over-watering, without adding any manure. The proper nourishment of the land has been withheld from it for ages, when the *reh* grows up, and puts an end to all further agricultural efforts.

Arboriculture is one of the principal means, I am persuaded, to prevent future famines.

Koteghur, December, 1877. G. P. P.

INDIAN DYES.

SIR,—Though many facts of interest have, from time to time, been brought to notice regarding Indian dyes, other than those so well-known as indigo, lac, safflower, etc., it may be considered a somewhat neglected branch of our productive resources, when we look to the many native dyes yielding brilliant colors and capable of improvement, that are scarcely known to Europeans, but are occasionally seen in the brilliant colored cloths, worn by native females on holidays and festive occasions. Twenty such could be enumerated, which impart hues of great variety, and many of them of great beauty. True it is that the majority of these are not permanent, but this probably is owing to a want of chemical knowledge. All the shades of red, from scarlet downward produced from safflower are not permanent, there being no known mordant to fix the colors ; but there is one article which offers good promise of extension as a dyeing material, but which has hitherto been much neglected. I mean the *munjeet*, which, when there happens to be a scarcity of madder in the English market, is used as a substitute. No doubt its dyeing properties might be better developed, were more attention paid to its cultivation and mode of export. Though not much known in Europe, this article has been used in India from time immemorial for tropical dyeing upon silk cloth on which it produces many shades of red, from a pale pink to crimson, a variety of brown and chocolate hues, and every shade between a light purple and deep black. And these ends are so easy of attainment that the females of the household do not always apply to a dyer, but utilize the *munjeet* themselves, according to their different fancies. The varieties of *moriadees*, again, I am informed, afford dyes which might produce colors, not much inferior to the Turkey or Adrianople red, if applied according to improved processes. The whole subject is certainly deserving of close attention, and I sincerely trust, it will receive it, at the hands of those who may be engaged in compiling a full and detailed report on the various products which are, or can be, utilized in dyeing.

The Department of Agriculture and Commerce will doubtless be able to afford valuable information on the subject, for it is a question whether there is a city in the whole world, where more colors are displayed in clothing than Calcutta.

WATERFORD.

Calcutta, 4th January 1878.

THE DEEPENING OF SILTED TANKS.

SIR,—In your issue of January 1877, I advocated the deepening of silted tanks, and the reclamation of their shallow margins, as a famine work, little expecting that I should have an opportunity of carrying the same into personal practice. As the result may not be without interest to some of your readers, I will give some of the details. The shallow margin of a tank is always opposite the bund or embankment which is generally its deepest part. When there is but little slope in the bed of the tank, there is a large shallow margin, where water ebbs and flows, spreads and dries up, and by so doing, and by the stench of the decaying water weeds, is thought to be prejudicial to health, especially if to windward of, and in close proximity to, a crowded town. The great evaporation from an extensive shallow surface of lukewarm water, has also an appreciable effect in lessening the irrigational capacity of what may be called, in Bengal, a *jheel*. It was thought that the reclamation of 69 acres of the shallow foreshore of a tank in this town, would be beneficial, both to the health of the town, and also by lessening evaporation, prevent waste of water, and add land fit for profitable cultivation. I should state that the area of the tank is 500 acres, and that the average depth, when full, is not over 3 feet. There are 2,400 acres dependent on it for irrigation, but as this is, what is called a channel tank, or one supplied by a channel, conducted from a weir across a river, it would not suffice for more than one month's irrigation, unless the continuous ingress of water nearly equalled the consumption.

The estimated expense of the reclamation of 60 acres of foreshore of this tank was calculated in 1870 at Rs. 39 000, or at the rate of Rs. 600 per acre, raised up to high water mark with silt taken from the deeper part of the tank. To do this, in the least unsightly way, so as to show a series of terraces, involved a longer lead, than a mere trench, and embankment style of reclamation would have necessitated. Moreover, the whole outside margin of the reclamation was stone rivetted, which was not in the original estimate. During the late famine, there were among the poor of the town and its hamlets, about 2,000 persons in need of work. Many, in fact the majority, were weavers, who had no orders for their goods, or sale for their cloths. These, with their delicate hands, were not adepts with spade and pick, but in time, became very fair workmen. Sections of work were marked out and executed by the people in gangs, who were paid once a week. All employed had credit with the merchants, in consequence of being on the roll. The extent actually reclaimed on this occasion was 24 acres, raised on an average 4 feet; the lead varied from 50 to 150 yards; with the short lead, 12 cubic yards were cut and carried for the rupee, with the longest lead, 6 yards. It was employment for 6 months, and when it came to an end, from the tank receiving a supply of water, and so closing all work in its bed, the weavers got Government orders for their cloth, which however, to prevent damage from mildew, white-ants, rats, &c., had to be sold at a discount. So that on the whole, the reclamation work was more profitable and economical than advances for cloth.

It was calculated that 100,000 cubic yards of silt were excavated from the deeper part of the tank, and storage of that quantity of water, exposed to a less evaporation, provided. In fact, instead of being spread out over a shallow surface, it was stored in a deeper channel. The land reclaimed was immediately cultivated, in June and July. A cocoanut plantation was at once formed, 2,000 trees planted, a crop of raggy was also sown. This was cut after 4 months, and though somewhat laid and damaged by the heavy rains in November, realised Rs. 1,300 for the grain. Raggy straw is not much accounted of as fodder, but 22 tons of it were stored for the Municipal bullocks, who get little else, and apparently thrive on it, about 2¼ acres were sown with cholum. This, from the extremely rich character of the soil, grew too much to stalk. Some being 15 to 18 feet high, without heads, conformable thereto. The cholum realised Rs. 32, and 11 tons of the stalks were stored as fodder.

No sooner were the raggy and cholum off the ground, than sugarcane, wheat and tobacco have been planted; in fact, 2 crops may be looked for with certainty, as all the reclaimed land has been provided with wells, in the proportion of 1 bullock well to 4½ acres, and 5 *picotta* or lever wells for 5 acres; a good deal of the country tobacco leaf attains a length of 32 inches by 15 in breadth, or ½ more than ordinary tobacco.

The sugarcane appears most thriving. The work though done by famine labour, was completed within the estimate of Rs. 600 per acre, and the additional plantation will tend to lessen the aridity of the climate, which is sometimes months without rain. The difficulty in making plantations in an arid climate, is to water the trees; in a moist climate they grow without any trouble. Even on a tank margin, unless well water is supplied in the dry season, when the bed of the tank is empty, cocoanut trees die, and they are the most profitable to cultivate; but reclamation of such a site, combined with wells, seems to meet the difficulty, waste land is utilized and a nuisance abated, and the tank improved by being deepened.

A. W.

Coimbatore, January 1878,

OUR WASTE OF MANURE.

SIR,—I have read more than once, and with much interest, your articles, not only on agriculture, but on all other industries in India. I admire the patient and persistent efforts you are making as a journalist to give us line upon line and precept upon precept,—and if possible to create a healthy public opinion in favor of improved agriculture. But I must confess to a want of confidence, or lack of faith, in any direct fruits from this personal influence; simply because of the kind of material upon which this influence is to be exerted. I mean in plain words, that such is the total indifference of the official class, both English and native, to agriculture and other industries in India, that any amount of personal influence exerted by and through, an Economic Museum, Seed Depôt, Botanic Garden, and other agencies you mention, in your article, will fail to produce the desired results. There is a maxim found in the good book, that has a very wide application both to men and things—"By their fruits shall ye know them." Let us take this maxim and measure if possible, the kind and amount of influence exerted by English officials upon agriculture. Can there be found, even at this late day, around any of our large civil stations, improved agriculture in any form whatever, produced by direct personal influence or efforts of English officials. Let us take for instance the Umballa district. I have known this district well nigh twenty-five years. In 1855, I made myself acquainted with the conditions of village life, and the state of agriculture prevailing in the district. I have kept up my acquaintance with the district from that time till now, and I venture to affirm, that not only has there been no decided improvement in agriculture, but over a large part of the district the fertility of the soil has diminished, and a decrease in the crops has been the result. There are some portions of the district that possess a very deep soil of surpassing richness, and any amount of wretched, shallow farming does not materially affect such land. But a large portion of the district contains a lighter soil, more easily worked, and more readily impoverished by bad farming. Yet with a generous supply of manure, these lands would become the best among the wheat lands in India.

There are more than 850,000 acres of such land in the district. Upon all these acres, wheat has been sown year after year without manure, and of course the soil is exhausted. Yet there is no lack of manure.

The whole land is thickly populated: large and very populous villages are everywhere seen. In and around these villages, there are large heaps of manure and filth: guano-beds of priceless value to the land. All the while these beds have been increasing, the fertility of the soil has been decreasing—two correlated facts tell the whole story. Another sad fact follows. With the increase of population in these villages, and consequent increase of filth—that ought to have been given to the land—there has been a corresponding increase of fever: scarcely a village in the whole district, in which fever has not increased more or less during the last twenty-five years. During these long years, there has been a Commissioner sitting in the Cantonments, and a Deputy Commissioner, with a large number of Assistants, sitting in the Civil Lines. These officials have drawn thousands of rupees from the public treasury, to bear their travelling expenses in touring through the district: and yet with all this expense, no official influence whatever has been exerted to remove a single "guano-bed" from the villages, or improve a single acre of land. Almost within a stone's throw of the public buildings in which the Deputy Commissioner and his Assistants hold office, there are wheat fields with the soil so exhausted that the yield of wheat is scarcely one-fourth of what the English farmer produces. And within an hour's ride of the Deputy Commissioner's home, there are large villages around which are large deposits of manure, which if within reach of the English farmer would fetch thousands of rupees, and the lands all around these villages too exhausted for really profitable cultivation. These deposits of manure, as they now are, only give fever to the people; —put where they ought to be, in an exhausted soil, most abundant crops would be the result. And yet during these many years, no English official has exhibited even so much of interest in behalf of agriculture, as to spend an hour in riding out to these villages, and using his official influence to induce the people to cleanse the village, and thereby enrich their fields.

If we turn our attention to other districts, we meet with the same class of facts, that we have noticed for many years in the Umballa district. Let us take as another instance, the Simla district. Much of the land in this district may be classed as sterile. There are, however, some very remarkable exceptions. These may readily be seen along the road from Simla to Fagoo. The soluble matter of decayed vegetation in former times, has been taken up by rainwater and deposited in the primitive soil, in some places to the depth of two feet. Such soil is of surpassing richness, and any amount of ill-treatment from bad farming would cause no very permanent injury. But much of the land under cultivation is very poor indeed. Some of it we can scarcely call soil, for it is simply disintegrated rock not yet decomposed. It takes in water most freely, and as the water passes through it, carries off much of the soluble matter which is the nutriment, or food, of the plant. Such soils must have the very best treatment,—must be constantly *repaired* by an abundant supply of manure, or they become sterile. The food-supply for the people is greatly diminished, and the people are continually impoverished. If anything like successful agriculture is carried on in the district, the utmost care is required, and constant efforts must be made to collect a sufficient supply of material to fertilize the soil, and yet what do we see along the great highway passing through the district,—"guano-beds," that have been accumulating for years, at every little shop and camping-place on the road—heaps of fresh manure close on the road—or thrown off the edge of the road down gullies, to be washed off by the next heavy shower of rain. Only a few weeks ago we travelled on foot over nearly the whole length of this imperial highway. The traffic during the last season had been immense. We were told that well nigh two thousand five hundred mules and other beasts of burden, had been on the road during the whole season, from the plains to the interior as far as Rampoor. Every little camping ground was covered with manure, and the old "guano-beds" we have noticed for years, greatly increased. Beyond Simla, *ata* was selling at 2 annas per seer, all of which was brought from the plains, and the villagers along the road told me they had scarcely three months' supply of food in their homes. Wheat had just been sown in fields, many of them so sterile that not one-fourth of a crop could be produce. Within a hundred yards of these fields, there were heaps of manure on the greatest public highway of English travel in India, and these heaps remained untouched, though they were worth hundreds of rupees on a sterile soil, and without which successful agriculture is impossible. As we travelled along the road, we noticed that the English officials were out in the district, travelling on this great highway at public expense, looking after the interests of the district and the welfare of the people. They did not appear to notice the many places along the road, filthy beyond description. They must have known that *ata* was selling at two annas per seer, all of which was brought from the plains. They must have known, or ought to have known, that the food-supply of the people, would scarcely last three months; and winter was fast approaching. They might have seen those sterile fields, and an abundance of the material close at hand, which is the one only remedy in the world for unproductive soils; yet these English officials passed along the road, caring for none of these things. Such a state of things does not tell in favour of the high morality of officials, who draw their pay almost directly from the hands of the farming class; nor does it stand to the credit of any enlightened Government, in whose domain the one great industry of the people is agriculture. We here apply the maxim we have mentioned from the good Book—We judge of men by what they do. And we must conclude from all we have seen of official character of late years, that any efforts to develop the agricultural resources of India, through the present class of English officials, will be an unhappy failure.

M. M. CARLETON,
Missionary.

In Camp, Kurnal district, January 16th.

WHY DO WE MANURE?

(To the Editor "Ceylon Times.")

SIR,—The usual, so-called scientific answer to the question "why do we manure" is, that having withdrawn from the soil certain elements in the shape of crops, we must return an equivalent, so as not to impoverish the soil. This is a far-fetched answer, and a plainer and more correct one is, "because it pays." If manuring does not pay, the man who manures is simply squandering money, let the soil be ever so much enriched by the operation. This seems simple enough, yet is often lost sight of, on account of the host of wise arguments that any element withdrawn from the soil must be returned. There is no necessary connection, between the withdrawing of elements and their restoration. We withdraw elements in reaping crops, and we restore elements, if we are thereby enabled again to withdraw an amount of crop which will repay us for the outlay with interest; just as any other question in farming, manuring must be looked upon from the money point of view.

It is quite true, that in the majority of cases manuring does pay, and the man who can turn this branch of agriculture to the most profitable account, is, other things being equal, the best farmer; but the question whether he manures highly, lightly, or not at all, is quite immaterial. There is no greater danger for a planter, than to pick out a sentence from some scientific work; if he is not prepared to study the whole and master the principles, so as to enable him correctly to apply them to his own particular circumstances, he had far better leave the whole alone and trust to his experience and common sense. Although now-a-days a man who does not understand the theory of his trade, is barely able to hold his own, still of two evils he must choose the lesser.

But why should planters, of all men, have such a horror of theory? Sailors, clergymen, lawyers, merchants, soldiers and engineers, in fact every one, has to study theory. Does it stand to reason, that planters alone should be excepted? Is the theory of their trade so very difficult and dry? On the contrary, I cannot imagine a more agreeable study than that of the laws governing the growth of plants, and the only explanation why they are so little known to those most interested in them, is, I suppose, because the information contained in abtruse scientific works has not as yet been sufficiently popularised. That a good many planters are sensible enough to desire information, if only it be presented to them in an intelligible form, I have not the slightest doubt; and it is for those that I write, in the hope of doing them a service, though regretting at the same time, that the work has not been undertaken by an abler writer. To the others who do not wish to know more than their fathers and grandfathers did, I would only say, that to be consistent they must journey to Kandy in a bullock bandy, and never dream of using the telegraph matches, or any of the other modern "notions."

Why is manuring, as a rule, found to pay? For various reasons:—

1. Few soils are so rich, that their yield cannot be increased by manuring.

2. As export crops are produced to a great extent, at the cost of the substances forming the soil, the latter must, if no return be made become impoverished in course of time—it may be in one, it may be in a thousand years only—to such an extent as to render it unable to bear paying crops.

3. A chemical and physical change in soils often increases their fertility.

We therefore, may call "manuring" every addition to the soil with the object of increasing its yield, and "manure," every substance used for such purpose.

The first reason why manuring mostly pays, needs little explanation, although it seems as a rule to be overlooked in Ceylon where the common phrase is, "I have virgin soil, so do not require manure until after a few good crops." If any planter should fancy "virgin soil" to be the embodiment of all that soil should be, he is greatly mistaken, for virgin soil, especially in Ceylon, is often very poor. Moreover, manure being "required" or "not required" is an objectionable phrase; it should be manure "pays" or "does not pay." It is surprising to notice what an amount of mischief is wrought by vagueness of expression, and how often an erroneous term leads to an erroneous idea. We are accustomed almost daily to hear of manure being "required," and gradually get an idea into our head accordingly, that we need not trouble ourselves about manuring, whilst quite to the contrary manuring is never actually required on a good managed estate, as it is found to "pay" long before its imperative necessity is felt.*

The only soils perhaps which can hardly be improved artificially, are those where, like in the Delta of the Nile, nature has deposited her treasures in the shape of silt and mould from time immemorial.

---

* If a planter does not manure a young estate, although it should appear profitable, simply because he does not wish to force the plants, he may be *right*; but this is quite another question.—Ed., *I. A.*

The second reason given must be looked into a little closer, for it has led to most serious errors, and was the main cause of agricultural chemistry having at one time fallen entirely into discredit. The argument formerly was simply to the effect, that because we withdraw by crops certain elements, impoverishing the soil in proportion, *therefore* we must always return the ingredients we have taken away. Half a truth often has the effect of a untruth, and so with this argument. Suppose sufficient available magnesia be contained in a soil, to last for a thousand crops, would not the man who spends money in returning magnesia be simply a spendthrift? We, no doubt, " improverish" the soil, theoretically speaking, by every particle we take from it without equivalent return; but from a practical point of view we must reason quite differently, and only trouble ourselves about those elements the re-supplying of which will bring us additional crops within a reasonable time—elements which will "pay." A banker does not pay a bill due in six months only; a merchant does not spend his money for goods he may require ten years hence, or a planter send cheques to his shop-keeper for the probable value of his purchase during the next five years; we all know that saving of interest means capital gained, and interest in truth is felt heavily enough by planters. Why should we therefore, waste capital, by burying it in the soil in the shape of manures which does not give us returns within a reasonable, *i. e.*, "paying" time, just to please unbusiness like theorists, who say " whatever substances are removed from the soil, must absolutely be returned"? Just as every other trade, planting is carried on merely for the sake of gain, and any operation which reduces our profit, is, *ipso facto*, opposed to the very first principles of planting, is a mistake. The planter must calculate at every step, and only follow abstract theory so far as it proves profitable. I need hardly add, that I do not advocate a short-sighted policy, such as taking from the trees as much crop as possible, regardless of the future; for a planter who acted in this manner would do just the opposite of what I recommend: he would do that which did not pay. But if a planter, by " sweating, " and finally abandoning an estate, could clear more money in the end than by drudging on in the usual way, I would pity him if he did not do so. There is no reason why we should look upon land, especially amongst the tropics, with a kind of paternal affection: as with gold-digers, so with planters is the soil the means, and not the object.

We must therefore always bear in mind, when speaking of the necessity of manuring on account of the impoverishment of the soil by repeated crops, that we must look far beyond any narrow-minded theory, according to which perfect manuring consists in the complete restoration to the soils of all the substances exported.

The third reason we shall understand more fully hereafter; but every one knows for instance the beneficial results accruing from lime on sour land, from bulky manures, in stiff soils. In the improvement of soils by manures, we have to consider not only the addition of food for the plants, but also the physical properties of the soil; and I may mention here, what will probably form the subject of some future paper, that we have to regard soil in its two-fold capacity *viz*, as the supplier of food to plants, and as their dwelling place. These are also called respectively, its chemical and physical properties, and the two are of equal importance.

BAMBOO AS PAPER-STOCK.

SIR,—As my name has been prominently mentioned in " Dr. King's report on the Calcutta Botanical Gardens," I beg space to make a few remarks thereon, inasmuch as it might be inferred, from the tenor of the report, that the successful employment of bamboo for paper making was dependent solely on the continuous growth, and the continuous cropping of the young stems or shoots.

I will not attempt to discuss the botanical issues of the question with so eminent an authority as Dr. King, but will admit that the parent clump or stool may not bear cutting down in its entirety, also that the shoots are only produced once a year, and that during a limited season, until, indeed, we learn from Dr. King's next annual report the result of his further experiments, confirming or modifying his present conclusions.

Assuming, therefore, that the experiments now being conducted under Dr. King's direction should not be successful, it fortunately happens for the paper trade, and those, like myself, interested in extending the supply of suitable paper-making materials, that, practically, to an inexhaustible extent of bamboo jungle exists in many districts in India, from which the stems can be collected in the regular season, without having recourse to any plantations, or to cutting down the whole young growth from one clump simultaneously, as I learn from excellent authority that if only, say, one-half of the season's growth of young shoots is cut, the stock is not injured, but rather improved thereby.

My great difficulty hitherto, in communicating with the numerous authorities and correspondents in India, has been to explain what I meant by young stems and shoots, and to clearly define the proper stage of growth at which they should be cut, previous to their developing too prominent a woody character; and this difficulty still exists, as the growth of the stem necessarily is determined by the variety of the bamboo, the locality, soil, and climatic influence, &c., and as the character of the stem, and its suitability for the manufacture of " paper stock" and paper, must mainly be governed by these conditions, to lay down a hard and fast line would obviously be out of my power.

Now, in discussing the laying out of a plantation (*vide* my pamphlet on the subject of " Bamboo Cultivation," page 8.) I assumed as a mere matter of calculation " that allowing the stems to be 2 feet apart, and only 12 feet high, 40 tons might be estimated as the yield per acre." I am very much afraid that Dr. King's experiment in cutting has been conducted under some misapprehension in this direction, and that he assumed this growth of 12 feet only in height should not be exceeded, as in the tabular statement in the report 50 stems are shown to weigh 680 pounds only, an average of 13·6lbs. each, this giving not more probably than 10 feet of stem available for fibre, and that also too young and immature, as Dr. King speaks of " wet" young shoots probably containing 80 to 85 per cent. of sap, being the result of only one month's growth, *viz.*, " starting from the 10th to the 20th June, and all cut down the 21st July." Had they been allowed to grow till near the termination of the rains, they would probably have attained a height from 20 to 30 feet, most of which would have been available for fibre, and necessarily also have materially affected the tonnage per acre.

In collecting, however, from the jungle or native forest, the yield per acre is hardly a question to be considered; proximity to a river or stream, by means of which bamboos can be readily conveyed to a factory for manufacture into stock, is the main point, and as I learn lately from British Burmah were these facilities exist, that stems of the season's growth can be laid down at Rangoon or Moulmein at 15 rupees, say 30*s.*, per mille, each mille nearly equal to the production of one ton of merchantable " paper stock," in that part of India, at least, plantations would not be needed, and I doubt not, under proper organisation, this cost might be further reduced.

Dr. King in his report refers to my " expectations of transmitting the bamboo in a rough dry state to England, there to be manufactured into paper; from this it might be inferred that what I propose is merely to crush and dry the young stems, in which case obviously, as Dr. King remarks, the machinery must necessarily lie idle for a large part of the year."

As this, however, is very widely different from my views and intention, Dr. King's remarks only partially apply, inasmuch as the mere crushing of the young bamboo shoots involves but a very small portion of the machinery for manufacturing paper stock as I propose.

To attempt indeed to transmit bamboo stems to this country, either crushed or uncrushed, could only result in certain and heavy losses, owing to the extreme bulk and lightness of the raw materials and consequent cost of carriage. It must be treated near where it is grown or produced. I propose, therefore, to convert the stems after crushing into stock—a fibrous or tow-like condition, this being effected by a modification of the process practised with all raw fibrous materials employed in paper-making, *viz*, boiling in alkali, washing, reducing, or teasing into tow, drying and press baling for economy of transport, so that the paper-maker, on the stock arriving in this country, could readily inspect the quality of the article he was purchasing, and would merely have to bleach and convert the same into paper, either by itself or blended with other materials, as now practised with rags, thereby, and this, now-a-days, is no unimportant matter, avoiding " the so-called pollution of streams."

The plant and machinery to carry on this manufacture being of a bulky character, consisting of steam boiler, boiling pans, and adjuncts, drying apparatus, hydraulic presses, &c., must necessarily be located in a central factory to which the bamboo stems would be brought. The crushing rolls, which form a very small portion of the machinery needed, are not costly, neither are they very bulky or weighty, and so constructed and worked as to be readily transported from place to place on a plantation, or to special localities in the native jungle or forest; the young shoots as collected and cut may be at once crushed, and can then be made up into faggots or bundles, floated or towed, carried in boats, or where water carriage is not available, by carts or tramways to the central factory, assuming this so situated (as would be desirable) near the growing bamboos (plantation or forest.)

Dr. King raises an objection to the collection of the bamboo during only a limited season, but this can hardly be considered a serious difficulty, seeing that the same obtains with most other raw articles of produce from which our manufactured or semi-manufactured merchandise is derived, to name only a few, sugar, cotton, jute, coffee, tea, flax, and even rice and corn are all only produced at certain seasons.

In the sugar industry, for example, in which it is a necessity the cane should be cut and crushed when it becomes ripe, but little difficulty is experienced. Jute, flax and hemp, cotton and corn, are subject to similar conditions. I see, therefore, no difficulty in collecting bamboo, especially as, owing to the very large production of stems to the ground occupied, compared with any other fibrous material, and the facility of growth, the cost of the raw material is lower than any other with which I am acquainted.

At Syon-house, Brentford, the Duke of Northumberland's, may now be seen (the growth of this season) three stems from one stool of the *Bambusa gigantea*, one of which is 24 in. in girth 6 ft. from the base, and it has grown 60 ft. in height from the 6th September last. The two other stems are nearly as extraordinary, but in Burmah and the Tenasserim Provinces this growth is much exceeded.

I shall be happy to transmit samples of the bamboo paper-stock and paper to any one taking an interest in this subject.

THOS. ROUTLEDGE.

Claxheugh, 27th Nov., 1877.

The Indian Agriculturist.

CALCUTTA, FEBRUARY 1st, 1878.

FLAX CULTURE.

We believe there is a standing order of the Secretary of State for India, that every possible encouragement should be given to the cultivation of such products in India, as will supply English manufacturers with any raw material which at present is obtained from foreign countries. Flax must undoubtedly be considered one of these products, supplying not only in its seed one of the most important oils, linseed oil, but yielding also in its stalk a most valuable fibre, which has been known and utilised from time immemorial. Abundant evidence exists that, as in other parts of the world, so in India, the true flax was known and manufactured from very early times, but for the last two hundred years the manufacture of the fibre has entirely lost its ground; and in Bengal, in the present day, a man would be stared at, who would say to the cultivators that the stalk of their well-known *tisi* is rich in fibre, and would by proper management yield a valuable product. Nor is this a matter for wonder, seeing that under the system of cultivation practised in Bengal, the linseed plant seldom exceeds a cubit in height. The practice in Bengal is to sow the seeds of the plant broadcast in very imperfectly ploughed fields, and so wide apart as to allow the plants to become bushy and dwarfish. In the North-Western Provinces, the seeds are sown along with gram, safflower, wheat, &c., and the result becomes the same. In Oudh and Bombay it is likewise cultivated for its seeds, but never for its fibre.

Taking into consideration the extent, to which the flax plant is cultivated in India for the sake of its seed only, the absolute waste of all the fibre of the stalk, amounting yearly to some hundred thousands of tons, and taking further into consideration how much England depends on Russia, Belgium, Germany, and Egypt for the supply of flax to her manufactories, it is surprising to find that beyond some spasmodic efforts, entirely due to individual exertion, no systematic action has been taken by Government, to encourage the utilisation of this valuable fibre, now absolutely wasted.

Messrs Macallister and Co., of this city, the managing agents of the "Rustomjee Twine and Canvas Factory" have lately drawn the attention of Government to this subject. This enterprising firm has, for the past two years, been engaged in experiments of some magnitude in the preparation of flax from country linseed stalk; and having imported the necessary machinery, have succeeded in producing from the cast stalk of the country flax, grown for seed only, a [illegible] which has been valued in England at £28 to £30 per ton. Messrs Macallister do not, however, state the cost of preparing the fibre for the market, which is a very important point to intending manufacturers. We give therefore an extract from a letter by Mr. Wallace of Monghyr, to Dr. Spry, Secretary to the Agri-Horticultural Society of India, dated 21st August 1841, which contains some figures showing the cost of production. Mr. Wallace states that the expenses of *cultivation*, *rippling* and *steeping*, were more than covered by the proceeds of sale of seed. The cost of preparation of three tons of fibre, he gives as follows:—

	Rs.
Scutching of three tons after being broken or crushed by the rollers	190
Grain and grass for horses and bullocks, syces' wages, &c.	94
Peons and carpenter	10
Mofussil expenses and carriage to Calcutta	60
Boat hire and travelling expenses	10
Total Rs.	364

=Rs. 121-5-4 per ton.

A good margin is therefore left, even if we suppose that the fibre will not fetch more than £28, but we are satisfied that with careful manipulation, a fibre may be produced from the common country stalk, which will fetch £32 to £35 per ton. Mr. Wallace estimates the produce per *bigha* (of 3,600 square yards, ¾ of an acre) as follows:—Flax, "average crop 9 stone; 16 *bighas* for a ton"; tow 1st quality 36lbs., and 2nd quality 14lbs.; seed, average crop 3½ maunds. Russian Riga flax is worth in the Calcutta market now, about Rs. 550 per ton, or Rs. 20 per Bengal maund. Indian flax there seems no doubt can be produced nearly, if not quite, as good as Russian, and much cheaper; and Messrs Macallister desire especially to induce indigo planters to undertake flax cultivation, and not only to grow a few acres themselves, paying especial attention to close sowing, so as to get a better quality of fibre, but also to utilise their ryots' productions for the coarser qualities. The Behar planters especially, would benefit greatly by adopting flax manufacture as an auxiliary to indigo, living, as they do, in the midst of the great linseed-growing districts. There need be no great outlay, they have engines, vats, and buildings, they have generally at their command the raw material, and can grow it of fine qualities; and what is of more advantage than all, the manufacture of this fibre takes place at a season when they have little else to do. The chief difficulty seems hitherto to have been, to induce the ryot to remove the seed without damaging the stalk, and to bring the stalk without loss of time to the *retting* pits; but Messrs. Macallister say:—"this once accomplished (and our experience shows that from eight to twelve annas per maund of stalk offers sufficient inducement), the success of the remainder of the process depends almost entirely upon the superintendence which the work receives, and this, we may observe, requires to be of the best and closest description." Mr. Macallister adds, "I have found from experiments, carried on at Dinapore during the past season, that Indian linseed straw, grown by the native cultivators, is rich in fibre, but, owing to the mode of growing that fibre, is harsh, and that when planted thickly and grown for fibre only, the fibre is almost equal to Russian. Cultivators who wish to make the most out of their labor, would do well to plant double the usual quantity of seed to the acre, gather the stalk when the seed in the bolls is ripe, or the bolls have turned brown, thresh out the seed after two days' sun, and immediately immerse the stalks in water and follow the process, he details. Thus they will utilise the seed, and get a fibre useful to the

for making canvas for ships'
ich there is a large demand.
vas Factory" at Goosery, near
manufactured from imported
of sail and tarpaulin cloth, for
ould serve admirably. Mr. Macallister
valuable directions for the cultivation
, which we published in our issue of
as well as to page 41 and 74 of vol. V
of t *Gazette of India*, we refer those who
desire to fully into the subject.

Great attention during the various processes of manufacturing the fibre from the stalk, is necessary to obtain a good quality. The flax stalk consists of three distinct layers. The thin outward covering comes first, then the fibre, and in the centre of the stalk, the pith or woody portion. These three layers are permeated by gum and mucilage, and are held together by albuminous substances. To gain the fibre, those different portions of the stalk have to be separated, and this is done partly by chemical, partly by mechanical means. By natural fermentation, first the gummy, and then the albuminous substances which hold together the different layers of the stalk, are destroyed, and afterwards it is easy to mechanically separate the fibre from the rest, which by drying is rendered extremely brittle and friable, while the fibre maintains its softness and cohesion. The fermenting of the stalks is called "retting" and the quality of the fibre produced depends greatly upon the success of this operation. The following procedure is adopted by most of the large flax manufactories of the Continent and yields a fibre of very good quality.

After the flax has been "rippled," that is after the seed has been separated from the stalk, the stalks are turned up so as to get the roots at a level, which are cut off by a chaff-cutter or similar machine, so as to permit the water during the "retting," to penetrate more freely into the stalk, and to remove at the same time useless material. The bundles are then opened, and the stalks separated according to their length and fineness. The different qualities are made up into conveniently sized bundles, and are then ready for the steeping process. The indigo steeping and beating vats, are very suitable for the "retting" of flax. The bundles of flax should be loosely put into the vats and secured by beams or stones *under* the surface level of the water, but without unnecessary pressure, and then the vats should be watered. The water should have a temperature of from 75 to 80° F., and if necessary, the water must be heated to this point by introducing steam by an open pipe into the water carrying channel (the *moore*, of indigo factories), the flow of water being so regulated, as to heat up to the desired point. For thick stalks 90 hours, for thin stalks 72 hours of "retting" are sufficient to complete the process. The completeness of the "retting" can be ascertained by taking a few stalks out, when if the pith breaks easily and can be separated from the enclosing fibre without breaking the same, the process may be considered finished. The water, most valuable for irrigation purposes and possessing high manurial qualities, is then let off, the bundles are taken out, slightly washed in clean water, opened out and exposed to the atmosphere for two or three days on the ground; which lightens the colour of the fibre and improves its quality. The stalks are then gathered up in small bundles between the two hands, and put on their root ends upright together, to be thoroughly dried. The separation of the fibre from the woody substance of the stalk, called "scutching," can then be taken in hand, either by suitable machinery, or by hand labour over "scutching-blocks."

TOBACCO CULTURE.

WE seem to be determined to find some occupation for indigo planters, after the close of the indigo manufacturing season. Messrs. Macallister & Co. desire them to take up flax culture, and Mr. Buck, Director of Agriculture, N.-W.-P., tobacco culture. They have peculiar facilities for cultivating both or either staple, and for manufacturing them into marketable form, and there seems no doubt but that a good return can be obtained for the outlay. Mr. Buck whose note on Tobacco Culture we published last year, has issued a revised edition of it, in which some alterations and additions to the text of the former note have been made, and copious extracts included from an American work, *Tobacco Culture*, published by Judd and Co., 245, Broadway, New York. The conclusions arrived at by Mr. Buck, from the experimental cultivation on the Ghazipore farm, are that a yield of about 800lbs. of leaf may be expected from an acre of ground, and that when cured, this may be expected to fetch from 6*d.* to 7*d.* per pound in the home market. Samples actually sent from Ghazipore last year fetched nearly 6*d.* per pound. The profit, under these circumstances, is estimated at Rs. 2,160, on an outlay of Rs. 6,170 on an area of fifty acres of cultivation. The native cultivator rarely gets more than Rs. 5 a maund (generally only Rs. 4) for his cured leaf, which is equivalent to 1½*d.* a pound, or on one acre yielding 800lbs., Rs. 50, and on 50 acres Rs. 2,500 *gross value.* "Out of this," writes Mr. Buck, in a recent letter on the subject, "he has to pay expenses of cultivation, which I have charged to a planter at Rs. 4 a maund, or Rs. 40 an acre; or on 50 acres Rs. 2,000. There are exceptional cases (*e. g.* in which a field is watered from a nitrate well, &c.,) where an exceptional out-turn is obtained by the cultivator, and where exceptional profits are made. The latter are generally absorbed by the landlord in the form of rent. The out-turn of 800lbs., estimated in the pamphlet, is purposely reduced to a safe minimum. It is however quite possible for a planter, to raise per acre 1,000 to 1,200lbs. of good leaf, and also to reduce curing expenses below Rs. 5 a maund. It is also probable that Indian tobacco may be raised to a value of more than 5*d.* a pound. In any one of these directions there is room for enhancement of profits. A saving of 1*d.* a pound in expenses, or an increase of 1*d.* a pound in receipts, is equivalent to Rs. 2,000 per 50 acres, at the low estimate of 800lbs. of cured leaf per acre.

"The Ghazipore experiment" says the revised edition of Mr. Buck's pamphlet, "confirms the idea, which has often been mooted, that indigo planters or other gentlemen who have land in Upper Bengal, should attempt the cultivation and curing of tobacco. Operations required for tobacco-curing will apparently dovetail in well with those required for indigo manufacture. In the first place, the indigo godown can without difficulty be converted into a curing-house; in the second place, it is clear of indigo at the season when it would be necessary to fill it with tobacco. The same argument applies to labour and supervision. The busy time with tobacco will be from November to February, when indigo has been already sent to market, and even if it is necessary to keep tobacco leaf in the curing-house till the rains, it ought to be packed before indigo is cut."

The American work referred to contains fourteen "Prize Essays" selected from eighty sent in for competition, and, as the publisher observes, "gives the reader the benefit of the experience of a large number of practical cultivators residing in various parts of the country, nearly every one of whom refers to some item not discussed by others." The book has a very large circulation in America.

Copies of the revised note on tobacco now published, may be obtained on application to "the Clerk in charge of Office of Agriculture and Commerce, N.-W. P., Allahabad," and copies of the American book on *Tobacco Culture* will be procured for any one, who will forward an order to the same address. Any one who wishes to make practical experiments in cultivating and curing tobacco, is advised to procure the latter, with the caution that the directions are there given for carrying on operations in a different climate to that of the plains of India, and that many of the essays treat of curing tobacco without fires, a practice, however, which is not much followed in Virginia (the best curing State.)

WELLS AND WATER LIFTS.

THE question as to whether agriculture could be so improved in India as to prevent famines, writes our esteemed contributor "A. W.," is sometimes raised, but it can hardly be said to much practical advantage, as the invariable cause of famines is want of rain. Deep ploughing is held to be a panacea, but there is much land, which cannot be deeply ploughed, even if there were ploughs and oxen to do it; even an increased storage of a defective rainfall will not suffice. I have tried the plan of deep cultivation round the roots of avenue trees, and making channels to carry the rainfall drainage to the tree roots, but although all this extra water is absorbed in the ground, the effects of drought in a rainless climate, are shown by the fall of leaves and apparent hybernation of the trees after a long spell of dry weather. It seems doubtful also, whether manure would suffice, instead of rainfall, and the solar heat and evaporation differ so much in India from a temperate insular moist climate, that it seems doubtful whether, without irrigation, the ordinary home agriculture would suffice for India. The question whether any European in the low country could make a living out of the land, or farm it to profit, is an interesting one, because unless a profit be made, example is not likely to be followed. The competition in the grain trade is so great, the expense of carrying so bulky an article is so considerable, that unless there is a local famine it hardly pays to send grain by rail, and when 75 per cent. of the population grow grain for their own consumption, the demand is not great, and the prices are low; perhaps cheap tramways may make a better market for grain, but unless there be local famine, affecting the ordinary carrying trade by bullocks and carts, it is doubtful whether such tramways will much affect the prices of grain, or make its cultivation more profitable.

Trees, no doubt, have some effect on local rainfall, but they do not affect the periodical monsoons—which are sometimes averted, to the great loss of the country. There does not appear to be any real cure for this variations of seasons, through there are various alleviations. The railways and roads connected with them, carry grain, but they do not aid in any way, in affording the means of paying for it, and the bulk of the poorer classes in this country are grain producers, and not grain purchasers. Irrigation from rivers falls 50 per cent. and more, when rain is deficient, and irrigation from tanks, dependent on local drainage, is, of course, non-existent, after a long drought.

Some advantage is always gained by utilizing the underground supply of water, which necessity, and not choice, compels the use of—but the expense of lifting this water to the surface is the chief objection; a rough calculation would put this expense at a rupee a foot of lift per acre, for each crop. If water were offered to be supplied on such terms, it could not be paid, for Rs. 5 an acre for water enough to harvest a rice crop is thought a heavy enough charge, but the Rs. 20 an acre per crop from a 20 feet deep well, is paid in manual and animal labour, and not in cash. Under any circumstances, cultivation from wells involving a deep lift, must be always expensive, and it would be good both for the cultivators, and for their bullocks, if a less expensive mode of raising water were adopted. The improved lift has been several times described in this journal. There are now 20 at work in the Coimbatore district, chiefly in plantations, and it is found that 20 bullocks do the work better and with more ease to themselves, than forty formerly did, by the native method; and as plantations are impossible to be raised in a rainless climate, without artificial irrigation, it is necessary to eliminate every avoidable expense, and to economize bullock labour, fodder, and risk of loss.

The advantages of well cultivation are, that however bad the season, still always some crop can be raised. If the 20 foot lift becomes a 30 foot lift, by the lowering of the water level, the time occupied in the lift is prolonged, and the same quantity cannot be raised in the same time, but still it is cheaper raising a crop this way, than purchasing it, enhanced by the cost of carriage. As a matter of economy it must be cheaper to raise food on the spot, than to rail it from one district to another, and much more so, when the would-be purchasers, have not the means of buying the food, but are helped by Government by the institution of relief works, which would not otherwise have been undertaken, and by the provision of gratuitous relief, which, except that it keeps people alive, is a dead loss to the State. Wells cannot be dug everywhere, but they can be dug to an infinitely greater extent, and over an infinitely greater area of country than any other irigation works that could be constructed. They are moreover, the work of private enterprise. A failure in finding a spring, or by coming in contact with solid rock does not fall on Government. Those who dig them, use them—whereas it is said, that when some irrigation works are constructed at vast expense by Government, the ryots will, for some reason or other, not use the water and the expenditure is financially a loss. A well is a very humble affair, compared with an irrigation weir and channels, but as irrigational rivers are limited in numbers and strictly confined in space, a greater area might be irrigated, and is, in some districts, by wells, than by rivers and tanks, combined. If every ryot had a well, a famine would be unknown. It is an investment of Rs. 100 an acre, when the water is far below the surface, but it seems to pay the actual cultivator, who uses his own labour. No ryot without a well, in an ill-watered district, can be called substantial. No ryot that has a well, was ever an applicant for State relief. This fact is a suggestive one. The only crops harvested, during a great part of the famine year, were those under wells.

CANALS AND WELLS IN THE PUNJAB.

LAND in the Punjab and Sind is generally so unproductive *without irrigation*, the rain-fall being so small, that canals and wells are almost the only means by which the soil can remuneratively be cultivated. Canals are now generally distinguished as *perennial* and *inundation* canals: the *heads* of the former are taken from rivers in the neighbourhood of Hills, where a foundation in rock is met with: on the other hand the *heads* of inundation canals are taken from the *rivers* near the land to be irrigated, in the plains. The advantage of going so far, for a head to a canal, is that it is permanent: the advantage of taking the head of a canal near the land to be irrigated, is that it saves a great deal of expenditure: the *pros* and *cons* of these two systems of irrigation by canals have, therefore, formed a prolific source of discussion between irrigation officers.

Throughout their course in the plains, the Punjab rivers cut into the numerous sand banks within their beds, more especially during flood, and consequently the water is far more highly charged with silt, than is the case in the upper part of their course, where the banks and beds are of a more permanent character; it is obvious therefore, that under all ordinary circumstances, the water of inundation canals holds more silt, than the water of the perennial canals. The depth of water in an inundation canal varies constantly with the rise and fall of the river from which it is fed, whereas in the perennial canal, the depth of water flowing in them, varies but little throughout the year. It is the enormous quantity of silt carried by the rivers into inundation canals, from which arises one of the most serious difficulties the engineer encounters in the management of these canals. In case of simple inundation canals of the country, the silt can be removed by manual labour, when the water in the canals subsides at the conclusion of the season, though of course this annual operation adds very much to the cost of maintenance.

It is a well known fact, that when rivers are in flood, their current is very much stronger than during the period of ordinary flow, and most of the silt is then carried along in suspension, and is not allowed to settle. The same applies to the water in a canal. It is equally evident, that when a smaller quantity of water enters the canal, the *velocity* will be much less than during the period of flood, and silt in suspension at first, will gradually settle in the bed of the canal, as the depth of water in it becomes less and less. The depth of water in the perennial canal, on the contrary, is much more equable, the velocity undergoes little change, and comparatively little silt is deposited in the bed; consequently these canals are not subject either to silt obstruction, or to the cost of a heavy annual renewal of it. Again when the current of a river, during the season of flood, sets on one of its banks (above the head of an inundation canal), it often cuts away large tracts beyond the river bank, and a considerable portion of the soil thus cut away, is held in suspension and is hence sucked into the canal, by the strong current at its head. As the velocity of the water in the canal decreases, the silt held in suspension, is gradually deposited in large quantities in the bed of the canal, and it sometimes happens, that the mouth of the canal becomes so choked, that for the rest of the season, it can only be fed from the river during high flood, and so fails to supply the cultivators regularly with the water they had calculated on for their crops. It is therefore advisable to feed a canal from a "dhund" rather, than from the main river.

One of the most general complaints in the Punjab and Sind regarding inundation canals is, that the supply of water from them is uncertain, and sometimes fails, in the early spring, a time when the cultivator requires water not only to bring his winter crops to maturity, but also for his cotton and indigo. Inundation canals seem therefore but an imperfect means of irrigating a dry country like the Punjab and Sind, when unaided by irrigation from wells.

There is no happier lot for a cultivator, in any part of India, than to be the tenant of land on which he has *pucca* wells, and through which property a well lined inundation canal flows, the latter affording him the means of irrigating his land during the summer and autumn, without expensive labour, with the water of the canal, which is controlled, during the season of floods, by a regulating bridge (sluice) as an escape channel, at its head. With irrigation from "inundation canals supplemented by wells," the cultivator has generally water for his winter and spring crops, as well as a bountiful supply during the summer (when water is so much wanted) and during autumn. His cattle and labourers, which have been employed in raising water from the wells for the period when the canals are dry, can assist the cultivator during the busy harvest time as well as afterwards in preparing acres and acres of his land for wheat and other winter crops, which has been *flooded* for the purpose, by canal water. Flooding land for wheat and other crops, on sandy soil, appears not to be injurious to the general health of the people, living near the banks of a canal, in cases where the cultivator takes the trouble properly to prepare his ground for the reception of the canal water. Land that is irrigated from canals, should be *terraced* in a similar manner to the way land is prepared for crops, which are irrigated by a well, only the former terracing should be on a much larger scale. The cultivator, however, not unfrequently allows the water from the canal to run into hollows on his estate, where, of course, it collects and frequently becomes stagnant and foul. These places (should they exist) could easily enough be protected by means of small embankments, until the ryot has time to fill them up with earth.

Such of the crops as do not require much water, should be protected, by inexpensive earth embankments, made by bullocks and *kanes*.* Without water from a canal, a well can only irrigate a few acres of land, and well water is therefore so costly and valuable, that the cultivator cannot spare any of it for the purpose of irrigating land for *trees* and *grass* on his estate. In a country like the Punjab, subject as it is to so great a change of temperature, being very hot during May, June, July and August, and very cold during November, December and January, a supply of wood for fuel, on a poor cultivator's estate, adds very much to the comfort of himself and his family during the winter months, and the leaves and small branches of the Keekur tree give him food for his sheep and goats, should he not have sufficient grass. But it is only where a cultivator has canal water at his command, that he can grow the Keekur, with the exception of a few trees around his well, as besides taking up a large space of ground, when full grown, no crop will flourish under the shade of its branches. The Keekur and other trees give him timber for his hut, for himself, and work-people, and also wood for his wells and ploughs; and as the stock of wood for fuel increases in the country, the cultivator will use less and less cowdung, which would be so very valuable to him as manure for his crops.

One great advantage of inundation canals is, that they can be constructed and maintained by the *Chief Revenue* officer of a district, assisted by trained native officials, the actual work of *construction* and maintenance being done by the cultivators themselves; provided, that these canals have been designed by an engineer of experience in hydraulics, and he, the engineer, furnishes the revenue officer with clear, comprehensive and detailed specifications for the work. In this case the engineer's services hereafter would only be required, when the canal head has to be changed, and then only as a consulting officer. For the purpose of maintenance, every such canal should have permanent marks fixed at intervals, throughout the length of its bed, showing its exact *depth* and *breadth*, as a guide to the native official appointed to superintend the yearly clearance of silt. There is little doubt, however, but that the *perennial canal* with its head in the solid foundation afforded by rock, has many advantages over inundation canals, if the former runs through a country needing irrigation.

To many engineers, the rough and ready way of making *inundation canals* (as is met with in many parts of India) must be unsightly, (we refer more particularly to the huge masses of soil, frequently seen on either bank of inundation canals) but let us hope that in time, it may be possible to get the native officials, intrusted with the duty of constructing and maintaining inundation canals, to do their work with a greater degree of neatness.

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* (Kanes) A wooden scoop, drawn by bullocks.

With regard to the best means of keeping inundation canals free, as much as is possible, from *silting up their beds,* some more and some less, the best plan seems to be to line the canal properly and carefully with a well graduated slope of bed, and by regulating the supply of water, as far as it can be done, by escape channels and sluices, at the heads of canals. A cess of at least 10 feet, should be left on either bank of the canal, and the yearly clearance of silt, should be placed on the outside of the banks, so as to prevent as much as possible of this silt finding its way into the canal again. Experience seems to have proved that clearing canals by machinery, *as yet,* is too costly for India, where manual labour is so cheap. A steam dredger, however, so constructed as to easily cut though the sand banks, which sometimes form in a river, near the mouth of a canal, would be useful, as this is work natives cannot do unaided by machinery, at a time, when it is of great importance that this obstruction should be at once removed.

The amount, necessary to construct inundation canals in districts, where the cultivators themselves cannot afford the outlay of money required, might be raised, as has been so often suggested, by a land loan and improvement company, similar to the company, that has been so very beneficial to the *English land-owner.* In England "the amount *borrowed,* with the interest and expenses, is charged on the estate benefitted ; and repaid by a *rent* charge, terminating in *twenty-five years,*" so that if this plan of raising money, for inundation canals and wells, were adopted here, there would be *no water rate,* and the canal would become the property of the land it flows through, on condition that the cultivators maintain these works in proper order.

THE DEVELOPMENT OF OUR RESOURCES.

WHILE English statesmen and Indian administrators are disputing over the best means of saving India from famine, it is not uninteresting to notice other humbler projects for developing the resources of the country, and helping the population to find food, or the wherewithal to buy food. Extremely limited as all these efforts are, they may nevertheless, like Professor Tyndall's germs, contain in them the "promise and potentiality" of much higher forms of activity hereafter; and we are bound to recognise these beginnings, lest we should subsequently have to confess that the consequences have taken us by surprise. There can be little doubt that progress will be made, though he would be a bold man who hoped for progress with rapidity ; for this is inconsistent with the very elements of all problems relating to Indian industrial development. In short, one great difficulty in developing the natural resources of the Indian peninsula, is the primary fact that, generally speaking, there are no obvious resources to develop. If the country were rich in minerals or in metals, like England ; if it had vast empty spaces of wheat-growing land, waiting for the settler, like Canada ; if even, like Australia, it were capable of feeding unlimited sheep on lands fit for nothing else—the question would be reduced to one of statistics, and might be solved by a reference to the annual increment of population, and the annual extension of reclaimed soil. But in India we have to deal with conditions exactly the reverse of these. We have a country with little waste lands to invite settlers ; with no wealth hidden underground except such as, in the dreams of fancy, enriches the ruins of old palaces and castles ; and with less capability of breeding stock than probably any other country on the face of the earth. Some of these statements may seem to require modification ; but the exceptions, after all, are only such as prove the rule. There is coal in Eastern Bengal ; also in parts of the Vindhya range ; and perhaps, as civilisation spreads through the hills and jungles, we may find other mineral and metallic stores here and there ; but the paucity and inferior quality of them all is the most probable comment upon the good to be expected, to the country at large, from mining operations. In the whole range of British Himalayas—a mountain region before which the Alps of three kingdoms sink into insignificance—there is not, so far as we are aware, a single mine of any sort whatsoever. Somewhere beyond Almora, the local Government is supposed to be engaged in a final trial of old iron works, which have never paid their way with private capital, and are hardly more likely to turn out a success under State management. Waste lands, again, undoubtedly are to be found in many parts of India, and in vast areas ; but for all purposes of settlement they are practically useless. The Central Provinces are making an experiment of colonisation in the Hoshungabad jungles ; and on the borders of Rohilkhund and Kumaon, a similar process has been going on for the last ten years, with undeniably good results. But these reclamation schemes, from their very nature, are not calculated to add much to the resources of the country. The tracts settled in, do not by any means resemble those lands which, in more favoured countries, demand only labour to develop their apparently limitless productivity. Every square foot of ground in the Terai has to be reclaimed by slow toil from wild beasts and wild vegetation, amidst all the risks to life arising from both ; and the tiger or the jungle fever will occasionally compel the evacuation of the advanced posts of cultivation and order. In the older Settlements, indeed, thanks to the fertility of the soil, and to the absence of middlemen, the settlers live in comparative affluence upon the lands they rent directly from the State. But, when all is said, we can only take credit to ourselves for having called a comfortable class into being ; not for having made any measure of progress towards helping the vast indigent classes already in existence.

In truth, if we will look facts in the face, we shall never make progress in this direction until we can do two things together. To increase the productive powers of the soil is the first ; to raise the standard of comfort is the second. Without the former, the latter is obviously out of the question ; without the latter, the benefit of the former cannot extend beyond a single generation. In the cant phrase of political economy, however much the aggregate means of subsistence may be increased, if the standard of comfort be not raised, the lower classes will people up to the level of those means in a definite term of years. That the standard of comfort can be materially raised among the agricultural population, in our time is a proposition which one may fairly doubt ; but something may be done among classes a grade or two higher. It is hard, for instance, to believe that the progress of municipal improvement in all our considerable towns has been absolutely without effect upon the fashion of life among the well-to-do residents. Clean streets, respectable public offices, orderly lines of shops, roomy and convenient markets, decent systems of drainage—all these things are the history of the last decade in every Indian municipality, and the daily sight of them must have helped, if not to awaken a desire for greater social comfort, at least to lessen dislike of the sacrifices which attend all attempts at improvement. Viewed in this light, all additions to municipal revenue possess an importance other than that which is merely financial ; and some schemes appeal directly to motives which have little connection with finance. The attention of municipalities in the North-Western Provinces has lately been called to the advantage of converting waste lands into plantations of fruit trees. With care and patience, it is said that a profit of Rs. 50 an acre can be made in this way. Hitherto, all enterprises out of the beaten paths of municipal administration have depended upon the individual tastes of the magistrate in charge, and have died away upon his departure. Now, however, with a provincial department specially constituted to suggest and supervise industrial reforms, the orchard business may be kept steadily in view, and if it is found to pay in one or two places, the rest may be gradually induced to follow their example. The special facilities enjoyed by municipalities consist in this, that they can afford to wait for a protracted return to their capital, that they have any quantity of manure at their disposal, and that they can command an intelligent staff of directing officers. The matter may seem a small one ; but we must remember *that a good municipal fruit-garden, besides* bringing in money and setting a good example, would be a nursery of plants for all the private orchards of the district. An example of this may be found in Cawnpore, where three hundred mango grafts were put down last year, and all but twelve were bought up by neighbouring zemindars within the twelve month. These trees, and jack-fruit trees, are those which municipalities can undertake with least fear of competition, because they take some years to come to maturity, and native capital is invested chiefly in plantations which yield a speedier return, as guavas, oranges, custard apples, and so on. Other facts about these fruit gardens are worth remembering. There is a considerable sale of delicate fruits, such as grapes and strawberries, to the native population; one sign of an improvement in the standard of comfort among the inhabitants of large cities. Again, municipal orchards may be turned to account as feeders for the general arboriculture of the country. A scheme of this kind is contemplated at Cawnpore—a station which affords a good example of that influence of a magistrate's individuality which we have alluded to above. Thus, from municipal fruit-gardens we are led to provincial arboriculture, and here we enter at once upon climatic and meteorological problems, involving the most important issues for the productive powers of the soil.

These, however, do not come within the scope of our present intention, which is merely to indicate beginnings, not to forecast results. If the planting of trees were systematically and successfully carried out everywhere, the people might safely be able to use wood as fuel, without any risk of denuding the country; and this would be all the easier, of course, if India should ultimately prove able to supply its own railways with coal. In that case, there would be manure to spare for the fields, and we might start on a career of high cultivation. At present we have got no farther than a couple of sewage farms, and these, again, are connected with that experimental factotum, the Indian municipality. Still, it will be something to have established the usefulness of manure by the time that the cultivator generally is in a position to use the sweepings of his cowshed for growing instead of for cooking his food. Even now we can point to results which there is no disputing. Land has been taken up near some of the large municipalities of the Doab, at a rent of from Rs. 10 to 15 an acre, and five years' treatment after English notions, with the immense stock of phosphates derivable from a large city, have doubled, trebled, even quadrupled the leasing value. There is no reason why the same thing should not be done in every municipality in India. The relief to municipal revenues would be one obvious advantage, by converting their heaviest burden into a source of actual profit; but the good to the country at large should not be measured merely by this. If every large town were surrounded by an ever-widening belt of high cultivation, we might expect to see large villages imitate so practical an example; and the more so as it would be consonant with actual practice, which, however, lags very far behind the possibilities of the case. *Gauhân* lands always rent higher than outlying fields, but if an intelligent landlord were to take a leaf out of the municipal book, he might raise their rents much higher still. All this is *in* the future, and much will depend upon the success of an experiment just started at Allahabad, where the municipal committee, after long wringing of their hands over the dead loss involved in keeping the city clean, have at last embarked upon agricultural operations, and mean to carry them through. There are five or six years of waiting before them, but the advantage of municipal enterprises, as already mentioned, lies precisely in the fact that they can afford to wait.

When we name model farms, we have finished the catalogue of minor efforts to help India to feed her people. Model farms have until lately been managed much at haphazard. A better order of things began two years ago, in the North-Western Provinces, when they came under the administration of the provincial Director of Agriculture and Commerce. Systematic experiment in certain definite directions is the object and end of model farms; and the grand experiment going on at present is the cultivation of tobacco. It began two years ago, when the abandonment of the stud lands and buildings at Ghazepore left a large area for the prosecution of novel agricultural designs. These were impeded at the outset by protests from persons who claimed to have a reversionary right in the lands, so soon as they should cease to be devoted to a public purpose. The question was complicated by the absence of all records to shew the terms on which the lands had originally been taken up. All that was known was, that the occupation dated from the infancy of our rule in the North-West, when Ghazepore was a frontier cantonment; and it was shrewdly suspected that the taking up of land was a good deal more summary and less formal than it is now. However this may be, the High Court decided that the lands definitely belonged to the Government, and no time was lost in planting them with tobacco. A Virginian curer was imported, and the tobacco-growing and curing business has been undertaken by a firm, on an advantageous lease, for a term of years. At present, the Ghazepore tobacco is said by skilled American critics to be wanting in three things—flavour, gumminess, and gloss, and to be superabundant in stalk; but these strictures are accompanied by encouraging assurances that these defects can be remedied by care and patience. The tobacco can at least be smoked by Englishmen, for we are informed that several gentlemen resident in Ghazepore have smoked nothing else for several months. The British soldier is the patron whose custom is chiefly solicited; and perhaps we may yet see him supplied with India made tobacco and with India brewed beer. Our American friends express themselves highly disgusted with samples of the tobacco which the British soldier gets under present arrangements; and perhaps Ghazepore, if it cannot turn out first class Golden Leaf, can at any rate beat that. But Ghazepore is not the only scene of State tobacco curing. Another farm is to be set up in Kumaon, under a Mulatto imported from America; and it is believed that the chances of success will be even greater in the hills. The suggestion has brought up another, that is, a proposal for a great apple orchard in the lower slopes of the Himalayas; and this too is to be taken in hand by the provincial department of Agriculture. We may feel inclined to smile at all these petty enterprises; yet Jersey and New Zealand should convince us that a very respectable trade can be done in apples and fruits generally; and if the bullock-carts of Rohilkhund carry half as many apples as the neat little smacks of the Channel Islands, a very notable addition will have been made to the wealth of the country. All schemes like this deserve our best wishes. If we enumerate them, we do not indeed find that they muster very strong; but it is to possibilities, not actualities, that we should try to look; and these various little tentative measures may possibly lay the foundation of thriving industries in a not very distant future.

THE FAMINE COMMISSION.

WE look upon the proposed Commission of Enquiry as the means by which we may *prevent* famine in India, as the most important administrative step, that has been taken by the Government, since British rule was first established in the country. We may be allowed to express a doubt whether the Government itself apprehends the full importance of what it proposes to do by this Commission. Three to five "impartial" gentlemen are to be nominated as a Royal Commission, to report upon the steps which the Government must take to *prevent* future famine. We cannot control the rainfall—except to a very partial extent, by systematic and universal planting of timber—and cannot therefore *prevent* the great, direct, producing cause of famine. But though we cannot control the rainfall, can we not prevent a failure of the rains producing famine? No more vital question could be asked; and a Royal Commission of three to five impartial gentleman, is to be nominated to answer it. If impartiality were all that was required in such a Commission, we need not despair of an answer; but the Commission that shall answer the question satisfactorily, will need to bring to their task very special qualifications. We trust that no thought will be entertained of giving it a purely "official" constitution. Two members out of the five at least should be non-official; but that will probably be conceded. The great qualities that will be required in its members, are:—special knowledge, clear insight, real earnestness of purpose, and patience unlimited. If any notion is entertained that it will be possible for such a Commission to tell us within two or three months, or even two or three years, what steps will *prevent* the recurrence of famine when the next failure of the rains occurs, it had better be dismissed at once. The truth is, the Commission will be virtually called upon to produce an exhaustive report of the whole economic condition of the country, and the changes that must be made therein, to prevent a failure of the rainfall resulting in famine. If we set up a *dilettante* Commission, bent upon the mere perfunctory production of a Report that reads well, and reflects *kudos* upon its members, the Commission and their report will go together into the Limbo of frustrate activities, that have been so unceasing in the history of our rule. The Commission if it is to be of any real worth, must be able to tell us at the end of its inquiries, whether it is possible for us to prevent famine, or not. If it is possible, they will have to tell us the precise measures by which it can be accomplished. And they must do all this so clearly and convincingly, as to put an end to controversies on the subject, and commit the Government to action thereon. We had hoped that Dr. Hunter's great work would have gone a long way towards accomplishing the task set before this Commission; and his *Gazetteer*, in spite of the ability and labour lavished upon it, is disappointing we think for the little practical value it is to us. Let us now try to shew in skeleton form, the ground which this Commission of Enquiry will have to cover, according to our own apprehension of its task. Famine in India, then, may be regarded as arising from three great combining causes—namely (1) a failure of the rains; (2) the poverty of the people; and (3) the want of communications in the country The failure of the rains would not necessarily of itself produce famine. It is the poverty of the people, the fact that the masses live from hand to mouth, that makes a failure of the rains always mean famine. But neither a deficient rainfall, nor the poverty of the people together, would produce such famine as we see in India, if the means of communication between its provinces were well developed. It is a failure of harvests, the general poverty of the people, and the want of cheap and effective means of bringing food from distant provinces where it is plentiful—that together produce these calamities. And no proper answer can be given to the question to be propounded to this Commission, that does not cover and exhaust the three causes that co-operate to produce it. Though we cannot control the rainfall and compel the earth to yield her harvest, we may yet prevent the failure of producing famine, by getting the people redeemed from their present abject poverty, and by so perfecting "communications" in the country, that the surplus harvests of its most distant provinces, can be transported cheaply and expeditiously to the utmost extremities of the Empire. The range of inquiries, therefore, that the Commission will have to make, may be shown in skeleton form as follows:

- **The rainfall** ...
  - Arborescent cultivation ...
    - Forest conservancy.
    - Village sites.
    - Mango topes.
    - Road planting.
  - Artificial irrigation ...
    - Tanks and reservoirs.
    - Wells, *cutcha* and *pucka*.
    - Canals.
    - River weirs, bunds.
- **Poverty of the people** ...
  - Condition of the soil ...
    - Exhaustion.
    - Waste of manure.
    - Rude processes of cultivation.
    - Effects of irrigation.
    - Exhaustive.
    - Ryotwarree.
  - Tenure of Land...
    - Zemindaree, Malguzar
    - Metayer, *bhataee.*
    - Land revenue.
  - General indebtedness ...
    - Marriage ceremonies.
    - The sowcar.
    - Our civil courts.
    - Insolvency law.
    - Taxation.
- **Want of communications** ...
  - Improved river water ways.
  - Navigable Canals
  - Railways ...
    - Guaranteed lines.
    - State railways.
    - Private feeders.
  - Ordinary roads....
  - Sea transport ...

We do not think there is a heading in this synopsis, that should not be very distinctly dealt with in the Report. It is the second great division of the subject however, that will tax and test the powers of the Commission. It is the abject poverty of the people, that makes any failure of the harvests produce such suffering amongst them; and it must be the business of the Commission to lay bare the causes of that poverty, and to shew by what means they may be removed, or counteracted. The task is complicated by the fact that while this poverty is nearly universal, its causes are far from being uniform. Thus the general poverty in Oudh, may not be attributable to the same causes as the poverty of the ryots of the Deccan: indeed we know it is not: and if this report is to be an earnest, and not perfunctory, effort to describe the true condition of things in every province of India—it will be accomplished only by devotion to the work, and patient, resolute, earnestness to produce a true picture of the state of things. If in addition to this earnestness fo purpose, the Commission brings to the enquiry the special gift of clearness of insight, the power to discern what is possible to us and what is not—we shall have for the first time in the history of our rule, a statesmanlike review of the actual condition of the country as a whole, with the responsibilities and duties that belong to us as its rulers. We look upon the resolution to form this Commission as the most important administrative step that has been taken in India, in our time. The fear is that it will be allowed to degenerate into a mere enquiry of the usual routine order, its report to been tombed with all that have gone before it in the recesses of the Secretariat, instead of becoming a platform of solid ground, over every inch of which the practical administration has to go.

AGRICULTURAL STATISTICS.

WE publish below some important figures showing the extent of export of some of our staple products from the Port of Calcutta. The figures shew a vast increase in the trade of the Port during the past year. The clearances of wheat during 1876 were only 141,715 tons; 1875, 49,930 tons; 1874, 14,370 tons; and in 1873, 11,445 tons; against 256,725 tons in 1877.

The Jute figures shew that the crop of 77-78, must have been a good one, and there is no doubt, but that Bengal can supply the world with the raw material.

We also give some figures regarding linseed; a considerable quantity, however, of this staple, which in ordinary years would have been sent to Bombay for shipment, came to Calcutta during the past year, in consequence of the block on the Railways. The falling off in the export to the United States is fully accounted for—by the fact that the Americans have largely increased the cultivation of linseed in the far West—and it is quite possible that in another year or two, America will not require any foreign seed, but will become an exporter to Europe.

SEASON 1876-77.—Clearances of Jute, Rejections and Cuttings during 12 months, 31st August 1876 to 31st July 1877.

Total Bales	1,395,857
Same Months 1875-76	1,532,115
" 1874-75	1,486,621
" 1873-74	1,573,861
" 1872 73	1,866,502

SHIPPED.	JUTE, 350 lbs.			REJECTIONS, 400 lbs.			CUTTINGS, 400 lbs.		
	Season 1876-77.	Season 1875-76	Season 1874-75.	Season 1876-77.	Season 1875-76.	Season 1874-75.	Season 1876-77.	Season 1875-76.	Season 1874-75.
Total Europe	1,100,636	1,182,042	1,128,176	10,895	22,085	41,681	37,769	33,636	37,545
Do. America	* 32,822	† 40,455	‡ 37,836	12,610	15,242	4,901	181,9[illegible]6	231,155	215,745
Do. Indian Ports	13,389	5,046	17,419	..	..	594	..	..	..
Do Australia			2,724	..	..	..	..	..	..
Total Bales	1,152,607	1,229,997	1,186,155	23,505	37,327	47,176	219,745	264,791	253,290

* including 5,947 Bales to San Francisco.
† " 7,671 " "
‡ 19,601 " "

Season 1877-78.—Clearances of Jute, Rejections and Cuttings during 5 months, 1st August to 31st December 1877.

Shipped.	Jute, 350 lbs.			Rejections, 400 lbs.			Cuttings, 400 lbs.		
	Season 1877-78	Season 1876-77	Season 1875-76	Season 1877-78	Season 1876-77	Season 1875-76	Season 1877-78	Season 1876-77	Season 1875-76
Total Europe	762,876	688,293	588,910	10,22	7,144	5,118	27,067	16,099	7,204
Do. America	*20 651	†16,034	15,488	2,305	4,675	5,261	49,277	61,572	70,814
Do. Indian Ports.	12,898	2,101	2,321	..	..	..	..	..	..
Do. Australia	1,371	2,247	857	..	..	..	..	.	..
Total Bales	796,796	708,675	607,576	12,525	11,819	10,374	96 841	77,671	84, 48

* Including 4,000 Bales to San Francisco.
† Including 5,483 Bales to San Francisco.

Total Bales	... ...	905,655
Same Months	1876-77	798,165
,,	1875-76	701,998
,,	1874-75	814,650
,,	1873-74	763,357
,,	1872-73	899,731

Clearances of Wheat to Europe during 1877.

To London	via	Canal	95,658		
,, ,,	,,	Cape	94,187	189,845	Tons.
,, Liverpool	,,	Canal	9,870		
,, ,,	,,	Cape	17,406	27,276	
,, Hull	,,	Canal	10,710		
,, ,,	,,	Cape	1 275	11,985	,,
,, Dover	,,	Cape	......	350	,,
,, Cork	,,	Cape	......	3,245	,,
,, Falmouth	,,	Cape	...	16,286	,,
,, Continent	,,	Canal	7,338		
,, ,,	,,	Cape	400	7,738	,,
		Total ...	......	256,725	Tons.

Actual Clearances of Linseed during the year 1875, 1876 *and* 1877.

	1875	1876	1877
To Europe.	2,198,941 cwts.	3,283,858 cwts.	4,351,751 cwts.
To America.	1,274,964 cwts.	645,753 cwts.	637,921 cwts.
Total	3,473 905 cwts.	3,929,611 cwts.	4,989,672 cwts.

The quantity and value of exports of cotton from the Madras Presidency during the last twenty-two years have been as follow —

Years.	Quantity.	Value.
1855-56	21,013,464	25,21,351
1856 57	58.988.665	72,22,286
1857-58	55,015,309	87.71,724
1858-59	386,525,426	61,17,902
1859-60	62,512,527	95,97,135
1860-61	78.822,027	112,91,211
1861-62	87,544,471	170,40,215
1862 63	62 371,133	238,12 882
1863-64	72,490,886	447,18 112
1864 65	73,101,570	404,18 937
1865 66	120,034,215	484,16,348
1866-67	24,367,350	94,37,365
1867-68	49,286,131	123,65,500
1868 69	64,030,728	213,99,830
1869-70	68,513,748	191,25,050
1870-71	42,347,132	106,04,132
1871-72	75,329,127	1,72,05,095
1872-73	67,905,830	1,58,75,737
1873-74	61,522,169	1,28,33,988
1874-75	80,388,584	1,62,68 783
1875-76	82,143,068	1,65,28,491
1876-77	53,879,952	1,07,40,374

The value of the trade in this article twenty-two years ago was twenty five lakhs of Rupees, since which time it has increased, though with considerable fluctuations, to nearly six times that sum, the average of the last five years being 137 lakhs. During the interval between 1855-56 and 1860-61 the price of cotton ranged between two and two and-a-half-annas per pound. In 1861-62 it was a little over three annas, the quantity exported being eight and three-quarter millions of pound, and the declared value upwards of 170 lakhs. In 1862-63 the quantity exported fell by nearly 28 per cent., owing to the transfer of North Canara, and with it the trade of the important cotton-exporting port of Compta to the Bombay Presidency, but, in consequence of the American war and the unprecedented demand for Indian cotton in the English market which arose thereupon, the price nearly doubled and the value of the exports rose by upwards of 40 per cent. The price of cotton, and together with it the value of exports were steadily maintained in the year 1863-64, 1864-65, and 1865-66 during the continuance of the American war, and in the last named year the exports reached 120 millions of pounds, the highest figure recorded for the Madras Presidency. With the cessation of the American war, and as a consequence of the excessive demand for Indian cotton in the Manchester market, the exports fell at once in 1866-67 (eleven months) to less than two and a half millions of pounds. In 1867-68 the exports nearly doubled, and in 1868-69 quadrupled. Since then they have been fluctuating between four or eight millions of pounds in quantity, and 100 and 200 lakhs of rupees in value. The principal cotton-producing districts are Bellary, Tinnevelly, Kristna, Kurnool, Coimbatore, Madura, and Cuddapah. On the whole, the area of cultivation ranges between one-and-a half to one-and-three-quarter millions of acres. It can be increased to any extent, but at present there is not much inducement for extension, as the cotton produced is of inferior quality and cannot compete with American cotton or even Egyptian cotton in Europe. A very large portion of the cotton produced is consumed in the country, and there are large exports to Mysore and Bombay. The principal ports from which cotton is exported are Fort St. George, Tuticorin, and Cocanada. In the year 1876-77 the exports to foreign countries except Ceylon and to other Presidencies show a large decrease. This is attributable to the failure of the periodical rains in the years 1875-76 and 1876-77. The latter has proved altogether disastrous for cotton cultivation, but its effect on trade will be more conspicuous in the year 1877-78. Latterly there has been a considerable decrease in the exports of cotton to Bombay as large quantities are now carried by rail.

EDITORIAL NOTES.

PRESSURE on our space necessitates our postponing further notice on Dr. Ratton's "Manual on Common Salt," and also obliges us to let Mr. Robertson's Report stand over.

"Why do we manure ?" A very sensible letter on this subject appears in our correspondence columns, written by a Ceylon planter of great experience. Planters should not fail to read it.

We regret to hear that the crops in Mysore are proving very disappointing—not above a six-anna one in quantity, on the average. This result threatens a continuation of severe distress in the province. Crop Reports from Bangalore state that the ryots are busy cutting their crops of gram, but that on the whole, the results do not come up to the expectations induced by the splendid growth of the gram stalk in its early stages. A short time back the bean was attacked by a species of grub, and a blight ensued, which in many places destroyed the crop.

From Madras reports it appears, that a second crop can be obtained from the cut shoots of cumboo in favourable circumstances, such as low lying situations where moisture is plentiful. In such cases, the yield of the second cutting is said to be one-fourth of that of the first. Difficulty has been found in ascertaining the fact, because the ryots and village officers fear that the knowledge may be made the ground for raising rates of assessment or for refusing remissions. It is thought that a similar crop can be obtained from cholum also.

As the result of careful examination of the district of Cuddapah it is announced that the locusts have not done so much damage as was feared. It appears that not more than ten per cent. of the fields were badly attacked, and that even in these, half an average crop will be secured if the ears are not further injured. More than fifty per cent. of the fields are practically untouched. What is remarkable is, that the insects have partly eaten and then entirely left some fields, without doing very great harm. One interesting fact noticed by the Collector, is the belief of the natives that the locusts are either unable or unwilling to injure the grain unless it be soft and milky. This notion of theirs is borne out by the reports from the black cotton villages, where the locusts are said to have done little harm. The cotton and indigo crops have been entirely untouched. Raggi is said to have suffered. There are traces in many fields of the ravages of a green beetle-like insect, quite as injurious as the locusts, which has now entirely disappeared. On the whole, it does not seem that there will be any change in the situation from a famine point of view.

The prospects of the crops remain favourable on the whole throughout Bengal The price of rice continues to rise in several districts, owing to exportation. In Bogra, for instance rice is selling at 26 seers per rupee, which is "a very high price for the season of the year, especially as the *amun* harvest has been so abundant." In Durbungha also and Bhaugulpore, heavy exportation has raised the price considerably; while in Sarun "prices have greatly risen," but this may to some extent be accounted for by the fact that hail and frost have been doing considerable damage there. The mustard crop in the Chittagong Hill Tracts is said to have been almost wholly destroyed by insects.

Latest reports from Hissar state, that there had been no rain up to the 15th ultimo, but that the crops are doing well generally in the three districts of that division. The cattle are, however, still suffering from scarcity of fodder, and it is estimated that no less than 34,000 have died in the district; during the last six months.

There is a probability of very serious scarcity, and perhaps famine, this year in Cashmere. Already in some parts of the valley hardly any rice is procurable; and what there is, is stated to be damaged. In other parts, where the usual price of rice is 40 to 50 seers per rupee, it is not obtainable even at 12 seers per rupee. There is a threatening also of a grass famine; large numbers of ponies, cattle, and sheep have been starved to death. The failure of the *kharif* is stated to be owing to the heavy rain which fell at harvest time: up to the 9th January, there had not been more than 3 or 4 days of sunshine. It is to be hoped that the early rise of prices will stimulate the import of grain; but it is as well that intending visitors should be warned of the state of things in the valley.

Owing to the unusual rain in the beginning of December last, it is reported, that about one-third of the cotton crop in the Berars has been damaged. Previous to the rain, about two-thirds of the cotton crops had been stored away. In some districts the third picking of cotton is in progress.

We hear from Madras that the cotton crop is flourishing. A good deal was spoiled by the heavy rains a short time back, but the plants now growing, will yield largely. There is still much distress prevailing, but things are gradually improving, and prices are falling as the crops come in. The chief harvest will not be ready until some time this month, and then matters may be expected to right themselves somewhat. The numbers on Government relief works have been reduced to some four lakhs, and as this residuum is of the very poorest class, there is no expectation of any further reduction for six or eight weeks to come, when the heavy crops are gathered in, and prices fall to their normal level. The Government is selling off what remains of its purchase of 30,000 tons of grain. At first, the grain dealers combined to get it at a price absurdly below its value; they abstained from buying any at the prevailing rates, hoping to force the Government to sell it at "an alarming sacrifice." The Government in self-defence opened stores, where it was sold retail by the seer at a fraction under the market prices. This has brought the grain dealers to their senses, and they are now offering to buy in large quantities at a fair price, so as to secure the retail profit.

His Majesty the King of Siam has issued a proclamation in respect to the regulations in force for improving cultivation and extending the production of rice. The terms of the proclamation will have effect from 9th October last. The season, we are glad to hear, has improved so greatly in the large rice producing tracts of Siam, that there is every probability of the orders lately issued prohibiting the export of grain, being cancelled. The Siam Government has called for weekly reports of the condition and prospects of the season. In the early part of last month, the King of Siam personally inspected some of the large rice producing districts. The question of rescinding the late order has been referred to the leading members of the King's Privy Council for an expression of their opinion.

The crops throughout Japan are excellent, the cotton crop being twenty per cent. above the ordinary yield. There has been also a singular abundance of fruit and field produce of all kinds, throughout the country, being what the Japanese call *mansaku*, or year of plenty.

The attempt to grow hops in Cashmere, does not appear to have been a success this year. A letter from Dubgaon states, that the weather there has been more severe than the oldest inhabitant can recollect. Snow, rain and sleet have been falling continually, and there has not been twelve hours' sunshine, so the writer of the letter says, for six weeks. A great part of the rice and maize crops has been destroyed, and a large number of ponies and cattle actually starved to death. The zemindars complain also that their sheep are dying, owing to the scarcity of food.

The irrigation operations in the Punjab up to the end of November, show an increase of 102,323 acres irrigated as compared with corresponding period of the previous year, in short, owing to the demand for water on the failure of the autumn rains, more than double the area irrigated in 1876, has been irrigated in 1877. The chief increase has been on the Bari Doab Canal, where 111,000 acres nearly have been irrigated, in place of 40,000. As might be expected, the increase on the inundation canals is far the smallest, because the very cause which brought about the demand for water, stinted the supplies of the canals. Moreover, Mooltan and the adjacent parts had the heaviest rain of all the Punjab in September, and therefore the necessity of canal water for sowings of the spring crop, was less there than elsewhere. Until the December rains lightened their labors, the canal officers of the Punjab had very hard times, this autumn, in order to meet the clamorous and incessant demands of the agriculturists, who saw no hopes of rain. Their efforts have produced the very satisfactory results above, and it is only fair that these should be known to the credit of the Department.

At the meeting of the Anjuman-i-Punjab, to which we referred in our last issue, it was proposed and carried that, "the Government be moved to establish a model farm in connexion with classes on Agriculture, somewhat on the model of the Agricultural College at Cirencester." The Anjuman will endeavour to revive the Agricultural Company, which would give Agricultural experiments a practical field, provided the concessions originally asked for from Government, and which have since been conceded to others, are given to this company." A letter on the subject of the foundation of an agricultural college, which had been drafted by the Secretary, was approved and ordered to be submitted to Government.

Some interesting experiments have been made at the Cawnpore Model Farm, with the object of testing the lifting powers of the McComas' Australian pump, in comparison with the ordinary native method of baskets, called in the Doab *lehri*. Two masonry tanks were constructed, each capable of holding 500 cubic feet of water, for the pump a blind well, and for the baskets the ordinary receptacle, (*nanda*), were constructed, fed at the same level by an adjacent canal channel. The pump filled one tank in fifty-four minutes, and was worked by four men relieving each other in pairs. At the reservoir constructed according to the native method, two baskets were worked by eight men, also relieving each other in pairs. The second tank was filled in one hour and twenty-three minutes. The immense superiority of the pump is at once apparent, lifting as it did, an equal body of water in two-thirds of the time, and with half the labour. At the same farm may be seen the Biheea sugar mill: a machine of simple, almost rude construction. The expressing-power of this mill is very great, though no fair comparison has been made between it and the native *kohlu*. It is however strong, conveniently moved from one field to another, the parts, except the iron rollers, easily repaired, and would be largely employed by native land-owners, if they had sufficient opportunities of satisfying themselves as to its merits. We quite agree with our Lahore contemporary in suggesting that the simplest plan for making generally known the advantages of these two useful machines, would be, for Government at some central station to establish a Loan Association, which would let out to zemindars, pumps and mills, or encourage their purchase on the three years' system. Repairs could be executed in a large city which would be impossible in villages, and it is only necessary for these implements to be seen, to be used extensively.

We have received from Major Plant, the Deputy Commissioner of Thayetmyo, British Burmah, a very fine specimen of Cinnamon (*Laurus Cinnamonum*) indigenous in Mindoon Township, Thayetmyo District. We understand that experiments in the culture of the young tree will be made.

We hear that the cardamoms, sent from Burmah in the early part of 1876 to England from the south Tenasserim Coast, have been pronounced not to be equal to the cardamoms from the Malabar coast. We believe that the forest department has under its care a few of these plants in the Magagyee plantation, imported from India. We hope to hear of better results from the product of these plants.

Says the *Madras Times* : " Few persons there are now-a-days, who have not heard of the use of phosphates in agriculture. Many writers have treated of it in England, and the president of the Natural History Society in Montreal in his last annual address mentioned the subject as of great importance. Phosphates are an essential constituent in all our cultivated plants, especially in those which are most valuable as food. In order that they may thrive, these plants as well as others must obtain phosphates from the soil in which they are grown, and in proportion to the richness of the soil in this essential agent, will be the out-turn of the crop. Chemical analysis has shown that in the ashes of the wheat the proportion of phosphoric acid is fifty per cent., hence it may be understood how rapidly the cultivation of wheat exhausts the soil. Taking Canada for instance, where the extensive growth of wheat &c., was only recently adopted, the soil there has been completely exhausted, and in a country like this, where no manure of any kind is used by the native cultivators, it becomes a question how long the land will continue to be productive without the remedy we have alluded to, which is a liberal application of the phosphatic manure. The manufacture of this article is at present a large and profitable branch of British industry, and if a joint stock company were started in India for its manufacture, we are confident it will pay shareholders a fair dividend for their outlay." Is the *Madras Times* aware that several phosphatic manure companies have been started in India and fail to pay ?

Lord Napier, late Governor of Madras, has delivered at Edinburgh, a remarkable lecture on the Indian famine and its remedies. Lord Napier, in the course of his lecture, recommended the following points, which we have so repeatedly dilated upon, for the consideration of Government :—"To ascertain the proper use of rotation in crops in India; to introduce the use of root crops in lieu of fallow, without artificial irrigation; to make experiments on the use of water and sewage in the cultivation of cereals, grasses, and other vegetables now treated as dry crops; to make experiments on the application of manures, animal and vegetable to the soil, and especially on the use of lime, which is never practised; to introduce new and improved instruments of rural labour, and labour saving machines; to improve the races of working cattle, horses, sheep, and goats; to enforce with the greatest energy the formation of fuel-reserves in connection with every village, so as to save the manure for the soil, and to make experiments on the different varieties of trees, native and foreign, appropriate to this object; to promote the multiplication of fruit trees, and of trees useful for manufacturing and medicinal purposes. For the prosecution of these investigations it would be necessary to institute experimental [illegible], not near the Presidency towns only, but in a variety of situations in the rural districts, and to place them under the direction of first-class English agriculturists, with views both prudent and enlarged."

MISCELLANEOUS NOTES.

THE Secretary of State has, we are informed, sanctioned the indent of the Government of India for a Bruce dredger for the Sone Canals.

We understand that the late Commissioner of Dacca has sent an order to Messrs. Thomson and Mylne, of Beheea, to forward a sugar-cane mill to be worked on the estate of Nawab Ahsun Oollah. About 1,300 mills will be taken this season in Behar. The N.-W. P. Government has taken 60 for twenty-two localities.

Three guano islands have been discovered in the Indian Ocean by Captain A. T. Webber, of the American schooner *Saddie F Caller.* The Captain reports:—" On the 27th May last, being on a voyage from Browse Island to Kœpang, Timor, I discovered a group of three islands surrounded by reefs extending in diameter to about 18 miles, in a north-east and south-west direction, lying between latitude 12° 6′ and 12° 25′ S., and longitude 122° 45′ and 123° east. Came to anchor at the north side of the reef, at a spot from which the north-west island bearing E. by S. ½S. and the middle island bearing S. S. E. On investigation I found all the three islands covered with a thick deposit of guano, remarkably rich in ammonia and phosphate. Between the eastern and north-western island there is an entrance in the reef harbour for vessels of any tonnage. On reaching Kœpang, took immediate steps to secure the privilege of removing the guano from these islands. The highest point of any of these islands does not exceed 23 feet above sea level, the greater part being about 15 feet. "

At the Agri-Horticultural Show, held at the Laul Baugh, Bangalore, on the 15th January, 1878, there were two excellent ploughs exhibited by Mr. Wallace junior; they were light, and were said to be more suited to the country than any the judges had yet seen. We understand that Mr. Wallace has those ploughs for sale.

An Agricultural Show on a small scale was held at Kabina in the Rungpore district under the auspices of the public-spirited zemindar of the place, Baboo Mahimarunjun Roy Chowdry, at the commencement of this month. The district officers of Rungpore were present.

We hear that Nawab Ahsun Oollah, the well known zemindar of Dacca, intends holding an Agricultural Show, which will be contributed to chiefly, by the tenure-holders and ryots of his vast zemindaries. A succession of these Shows is well calculated to lead in time, to some improvement in agricultural operations. It will, we believe, be well worth attending.

The articles which are to be sent from Netherlands India, to the Paris Exhibition, are now being exhibited at Batavia. The collection is very comprehensive and very interesting, owing, above all, to the Government exhibits, to which the mining department and that for boring Artesian wells furnished extremely important contributions. The collection of specimens of produce was so great, that although three roomy galleries were taken up by the exhibition, 80 chests of exhibits had to remain unopened. The tea culture is represented by a very interesting collection of specimens. The cinchona culture is also represented by a smaller, but neat collection. The Batavia journals state that seldom has such an abundant and unusually varied collection of the different products and manufactures of insular India been brought together.

COMMUNICATED ARTICLES, &c.

THE BURMAH RICE MARKETS.

Under the Pressure of a famine in Bengal (1874.)

TOWARDS the end of November 1873 rumours began to circulate in Burmah that large quantities of rice would be required by the Government for the famine-stricken districts of Bengal. The supply of grain from the crop of 1872 was then nearly exhausted, the shipments from the 1st January having amounted to 600,000 tons, and Nga Kyouk, the only rice in the market, was selling at Rs. 72 per 100 baskets. Small quantities were being bought for the Government in a quiet way mostly from stocks in the hands of one firm, but the rumours soon began to effect prices which during the first week in December went up to Rs. 110 per 100 baskets, soon however to recede to Rs. 77.

Shortly after, there was again a considerable rise, Rs. 115 per 100 baskets having been paid for a stray boat-load or two of Nga Kyouk. In anticipation of high prices, some of the new crop of Nga Tsain was brought to market as early as the middle of December, for which Rs. 95 per 100 baskets were paid, and in the beginning of January supplies were somewhat considerable for the time of year and fetched Rs. 90 to Rs. 85 according to quality.

The arrangements for the supply of Bengal were left entirely in the hands of the then Chief Commissioner, Mr. Eden, who made agreements with two firms to buy all that might be needed. Their purchases up to the 15 January 1874, were made at about Rs. 90. From this date, under the orders of Government, rates were reduced to Rs. 80 for Nga Tsain and to Rs. 75 for Nga Kyouk.

These prices were equivalent to *6s.* 8½*d.* and *6s.* 7½*d.* per cwt., free on board ship for the respective qualities of grain.

At Akyab the quotation was *5s.* 8*d.*, at Bassein *6s.* 7¾*d.*, at Moulmein *6s.* 8½*d*, exchange being at par.

At the end of January no alteration in prices had taken place, and liberal supplies were being brought forward. Rates were somewhat reduced during the early part of February, Rs. 75 being the quotation for Nga Tsain and Rs. 70 for Nga Kyouk. Equivalent rates existed at Akyab, Bassein, and Moulmein. Supplies continued large until the end of the month with no variation in rates in Rangoon, but slight increase took place at the outports. Early in March the market, though firm, took an upward tendency, and Rs. 78 per 100 baskets were paid for Nga Tsain, an equivalent of (including extra charge for gunnies which had become very dear) *6s.* 9½*d.* per cent. free on board ship.

At Akyab prices also increased and equalled *6s.* per cwt.; in Bassein an advance to Rs. 74, or *6s.* 6½*d.* took place; and in Moulmein the same rate per 100 baskets was being paid. By the end of the months with scanty supplies and the pressure for March shipments, prices in Rangoon had advanced to Rs. 89 equal to *7s.* 6½*d.* per cwt. At Akyab quotations varied but little. At Bassein Rs. 82 had been reached, and at Moulmein Rs. 92.

Prices continued to advance, but early in April an agreement was entered into between the merchants to keep down rates, and in the middle of that month Rs. 98 was being paid with liberal supplies. This was equal to *7s.* 11½*d.* At Akyab the f. o. b. rate had reached *7s.* 1*d.*, and at Bassein Rs. 92 per 100 baskets, or *7s* 7¾*d.* was the rate in force.

No change took place in Rangoon in the ensuing fortnight, but the prices at Akyab went up to *7s.* 6*d.*, and increased Rs. 2 per 100 baskets at Bassein, while at Moulmein paddy was worth Rs. 95.

Slight reductions took place up to the 9th May. By the 21st of that month prices had further receded slightly in Rangoon, and with the commencement of the monsoon had been reduced much, both at Akyab (*5s.* 9*d.*) and Bassein (*6s.* 1*d.*) where supplies had become very limited.

In the beginning of June, supplies to the Rangoon market had dwindled down to a few boat-loads and for these Rs 98 per 100 baskets equal to *7s.* 8½*d.* per cwt. were paid. At both Akyab and Bassein the season was virtually over. The purchases on account of Government had also ceased at this time, and the shipments, which aggregated 289,534 tons, were made as follows :—

			Tons.
1873	November	... ...	3,035
,,	December	... ...	11 001
1874	January	... ...	27,718
,,	February	.. ..	35,783
,,	March	... ...	83,413
,,	April	... ...	60,707
,,	May	... .	55,297
Add from Akyab in	April May	... ...	12,530
		Total ...	289,534

About the middle of June supplies were larger and prices were reduced to Rs. 75 (*6s.* 4½*d.*) for Nga Tsain and to Rs. 67 (*6s.*) for Nga Kyouk. A month afterwards prices went up to Rs. 80 and Rs. 77 respectively, but the business done was very limited owing to stocks having become nearly exhausted. Some small shipments of white rice were made to the Straits in July and August, but there was little change in prices, and the season at the end of the latter month was considered over with the following export :—

		Tons.
Europe	... ...	455,472
Straits and China	... ...	11,285
India	... ...	285,027
Elsewhere	... ...	7,969
	Total ...	763,653

UNDER THE PRESSURE OF A FAMINE IN MADRAS IN 1877.

THE season of 1877 opened at Rs. 70 per 100 baskets, being Rs. 15 and Rs. 20 in excess of the opening rates in 1876 and 1875 respectively. Supplies did not come forward readily however, and by the end of January keen competition for grain had sent rates up to Rs. 75 equivalent to *5s.* 11*d.* per cwt. free on board ship, exchange being 1*s.* 11*d.*

In Bassein the market opened at Rs. 65, but soon advanced to Rs. 70 equivalent to *5s.* 6*d.* per cwt.

At Moulmein Rs. 70 to Rs. 72, equal to *5s.* 9*d.* were paid. During the following week, prices in Rangoon went as high as Rs. 77, but the merchants then combined and reduced rates to Rs. 75 or *5s.* 10½*d.* The latter price also prevailed at Bassein, while at Moulmein rates were for Rs. 70 to Rs. 72. Prices did not change during the remainder of February, and with a further reduction in Exchange, quotations for Europe were :—

Rangoon ...	... ...	5-5½*d.* per cwt.
Bassein ...	... ...	5-4½*d.* ,,
Moulmein	... ...	5-7¼*d.* ,,

Rates were slightly below Rs. 70 in the first few days in March, but with meagre supplies they soon increased, and by the 9th of the month Rs. 75 to Rs. 76 were the quotations in Rangoon, Rs. 74 in Bassein and Rs. 76 in Moulmein. A week after prices in Rangoon went up to Rs. 90, which brought large supplies; these caused a downward tendency, and on the 23rd March Rs. 82-83, equal to *5s.* 10½*d.* were paid.

At Bassein and Moulmein Rs. 80 prevailed, while at Akyab the quotation was *5s.* 11*d.* per cwt. Rates remained steady in Rangoon during the following fortnight, but advanced at Bassein to Rs. 84, and at Moulmein to Rs. 83-85. The middle of April saw the Rangoon prices again going up, and on the 20th of that month Rs. 90-93 were being paid for Nga Tsain, while the Bassein quotations were Rs. 87-88 and that at Moulmein Rs. 90 with small supplies. These rates were equal to free on boardship, per cwt. in

		s.	*d.*	*s.*	*d.*
Rangoon	... ...	6	7	6	9
Bassein	... ...	6	4	0	0
Moulmein	... ...	6	8	0	0

And at Akyab the rate was *6s.* 6*d.* Shipments to Europe from 1st January to 30th April were—

1874	... ...	366,586 tons.
1877	... ...	409,211 ,,

From this date forward prices were very high. On the 4th May in Rangoon they were ranging from Rs. 106 to Rs. 113 per 100 baskets "according to the degree of laxity allowed in measuring." At Bassein Rs. 100 and Moulmein Rs. 105 were the prevailing rates.

On the 18th May the quotations were as follows :—

					s.	*d.*		*s.*	*d.*
Rangoon	.. ...	Rs.	110—112	or	7	6	to	7	7½
Bassein	... ...	,,	107—110	,,	7	3	,,	7	5
Moulmein	... ...	,,	105—110	,,	7	4½	,,	7	7½

Exchange being 1*s.* 9¾*d.* At Akyab on the 10th idem *7s.* 10*d.* was quoted, rates became somewhat lower towards the end of May, but again increased in June, on the 13th of which month Rs. 115 per 100 baskets were being paid in Rangoon, while at the outports supplies were quite nominal.

By the 27th idem the prices had gone up to Rs. 123 On the 11th July Rs. 140 145 were the quotations; on the 25th Rs. 148 to 151 were reached, and at Bassein Rs. 140, and Moulmein Rs. 125-130. The beginning of August saw a temporary decline to an average of Rs. 140 but by the 22nd of that month quotations were at Rs. 147-148, and subsequently Rs. 160 were paid by the *Chetties* to one firm who had a considerable stock. The shipments to the 31st August from the 1st January have been to—

		Tons.
Europe	... ...	494,898
Straits and China	... .	22,662
India	... ...	127,603
Elsewhere	... .,	16,899
	Total	662,062

Statement showing the quantity of rice and paddy exported to Foreign and Coast Ports from the province of British Burmah during the first eight months of the years 1874 and 1877 :—

MONTHS.		Europe.	Straits & China.	India.	Elsewhere	PRICES IN RANGOON								
		Tons.	Tons.	Tons.	Tons.				*s.*	*d.*		*s.*	*d.*
January	1874 ...	25,676	1,256	32,190	962	Rs. 75	to 90	or for Europe	6	8¼	to	6	9½
	1877 ..	27,536	3,348	10,601	1,601	,, 70	to 75	ditto				5	11
February	1874 ...	77,103	2,158	45,657	1,170	,, 70	to 75	ditto	6	3	,,	6	4
	1877 ...	124,457	7,470	19,349	2,832	,, 75	to 77	ditto	5	5½	,,	5	10¼
March	1874 ...	161,159	1,933	91,973	1,796	,, 78	to 89	ditto	6	9½	,,	7	6¼
	1877 ...	109,353	4,322	36,707	8,557	,, 70	to 85	ditto	5	9¾	,,	5	11½
April	1874 ...	92,648	787	73,771	1,961	,, 98	to 110	ditto				7	1½
	1877 ...	87,965	1,451	23,780	2,520	,, 83	to 93	ditto	5	10¼	,,	6	8
May	1874 ...	48,976	1,128	39,547	590	,, 92	to 95	ditto	7	5¼	,,	7	7¼
	1877 ...	47,973	1,686	8,523	431	,, 106	to 113	ditto	7	2	,,	7	7½
June	1874 ...	22,986	1,803	2,538	756	,, 75	to 98	ditto	6	4¼	,,	7	8½
	1877 ...	24,129	1,169	9,605	195	,, 115	to 123						
July	1874 ...	7,514	2,505	147	470	,, 80	nominal.						
	1877 ...	7,605	1,010	3,617	359	,, 140	to 151						
August	1874 ...	9,410	2,365	104	264	,, 84	nominal.						
	1877 ...	5,980	1,426	10,331	371	,, 140	to 160						
TOTAL	1874 ...	455,472	14,255	285,927	7,969								
	1877 ...	494,893	22,662	127,603	16,899								

Exchange was much more in favour of Exports in 1877 than in 1874.

It will be seen from the foregoing that the bulk of the requirements for Europe were purchased at considerably lower rates in 1877 than in

1874; that the quantity of grain available for export in the latter year was much greater than that in the former; that prices went up exorbitantly in the one year about the same time as they began to come down in the other, and often by far the largest proportion of the crop has been shipped; and that the exports to India in 1877 were less than one-half those in 1874.

AGRICULTURE IN THE FARUKHABAD DISTRICT.

Compiled by the Settlement Officer of the District.

THE village of Bijadharpur is situated about three miles from the city of Farukhabad, and about two miles from the station of Fatehgarh, in a tract of country the value and fertility of which has been very much enhanced by the neighbourhood of a large city and a population of cultivators, who have learnt to take advantage of the large supply of manure available to them. In this limited tract there is carried on a system of agriculture which is the characteristic feature of the Farukhabad district, and the only one in which it differs materially from the surrounding districts. Under it, the land, fertilised by a most liberal supply of manure, is made to produce a triple crop year after year, the first being Indian-corn, the second, potatoes, the third tobacco. Bijadharpur is a very fair type of the class of village in which this system is in vogue. Besides the area growing the triple crop, there is of course a considerable area growing the ordinary *kharif* and *rabi* crops, but there is hardly any sugar-cane, cotton or rice. The soil of the village is the red Ganges *bhúr* or sandy soil, found on the right bank of that river throughout the length of the district. It is a firm, compact soil, and seems peculiarly susceptible of improvement from the application of manure. It is, moreover well adapted to the potato plant, which in the Doab is hardly ever grown except when the soil contains a considerable admixture of yellow sand. The village is well provided with irrigation: water being found at a depth varrying from 45 to 50 feet below the surface, while the wells contain water from 9 to 12 feet deep, fed by a spring not by percolation. The sub-soil is firm and no frame-work of wood or a wattles is required. Without any such artificial aid, wells last for very many years.

During the month of June, the old agricultural year comes to an end, the new year commences, the last hot weather crops are harvested, and the first ploughings for the rain crops begin. Of the statistics which have been collected, perhaps the most important and interesting are those relating to irrigation and ploughing. They show for some of the most important crops, (1) the number of times either operation takes place for each crop, and (2) the length of time it takes to plough or irrigate any unit of area. These two facts being known and the machinery employed whether men, or cattle, or both, being ascertained, we have a very accurate notion of the total cost involved on each account of crop under these two heads.

Let us first examine the statistics of irrigation; the following statements show, the total area occupied by each crop, how much of that area was irrigated, once, twice, thrice, &c, &c. The area is given in village *bighas*; the statistics were originally collected on the basis of this unit, the village *bigha* is about 4·21 of an acre.

Irrigation Statistics.

Crop.	Total area irrigated.		PORTION OF TOTAL AREA IRRIGATED.													Area unirrigated.
			Once.	Twice.	Thrice.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	
1869-70.	*big.*	*bs.*														
Indian-corn ..	42	14	30·13	2·13	6·2	2·7	..	..	..	..	..	..	..	..	..	115·15
Wheat ..	162	0	40·16	82·14	38·10	..	..	..	..	.	..	..	.	..	..	52·8
Barley ..	32	14	20·14	5·2	1·0	5·18	..	..	..	..	..	..	..	..	..	61·14
Gujai ..	39	1	..	31·6	7·15	..	..	..	..	..	..	..	..	..	..	182·5
Bijhra ..	26	8	6·15	19·13	..	..	..	..	..	..	..	..	..	..	..	128·12
Potatoes ..	87	14	..	..	..	..	5·19	2·13	19·17	15·5	30·17	4·11	8·11	..	..	..
Tobacco ..	43	0	..	..	..	..	1·9	1·9	..	10·17	..	10·12	5·4	..	1·11	..
Melons ..	34	7	0·10	1·6	1·5	9·16	8·19	8·19	..	4·12	..	..	..	..	..	0·10
1870-71.																
Indian-corn ..	190	0	1·0	.	..	..	..	..	..	.	..	..	..	..	..	155·7
Wheat ..	190	10	49·9	120·2	17·13	3·6	..	..	..	..	..	..	..	..	..	27·1[illegible]
Barley ..	46	18	25·7	15·19	5·12	..	..	..	..	..	...	..	.	..	.	10·1[illegible]
Gujai ..	38	10	27·11	9·6	1·13	..	..	..	..	..	..	..	..	..	..	29·1
Bijhra ..	16	1	13·17	2·4	.	..	..	..	..	..	.	..	..	..	..	13·1[illegible]
Potatoes ..	107	18	..	..	2·11	2·8	6·9	10·10	19·2	30·17	21·10	10·12	1·12	2·7	..	.
Tobacco ..	39	4	..	0·15	1·0	3·0	6·2	6·9	9·3	10·15	1·1[illegible]	..	..	..	..	..
Melons ..	47	3	2·8	11·18	13·11	10·6	5·8	3·0	..	..	..	..	..	..	..	..

Irrigation Statistics.—Continued.

Crop.	Total area irrigated.		PORTION OF TOTAL AREA IRRIGATED.													Area unirrigated.
			Once.	Twice.	Thrice.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	
1871-72.																
Indian-corn ..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	113·14
Wheat ..	134	10	119·19	10·15	3·16	..	..	..	..	..	..	..	..	..	..	74·12
Barley ..	13	0	8·17	2·9	..	1·15	..	..	..	..	..	..	..	..	..	10·3
Gujai ..	69	18	59·18	10·0	..	..	..	..	..	..	..	..	..	..	..	109·1
Bijhra ..	8	0	6·10	1·10	..	..	..	..	..	..	..	..	..	..	..	31·1
Potatoes ..	84	2	1·10	..	10·9	16·6	20·1	24·16	10·0	0·10	..	..	..	..	..	..
Tobacco ..	35	19	10·5	4·10	4·13	1·12	1·10	4·13	1·0	4·12	1·9	..	..	..	..	..
Melons ..	11	6	0·19	..	3·0	3·0	3·7	1·0	..	..	..	..	..	..	..	..
1872-73																
Indian-corn ..	...		..	..	..	..	..	..	..	..	..	..	..	..	..	146·18
Wheat ..	243	15	28·2	71·14	138·2	5·17	..	..	..	..	..	..	..	..	..	0·16
Barley ..	49	9	5·6	14·14	25·9	4·0	..	..	..	..	..	..	..	..	..	0·14
Gujai ..	86	2	0·19	29·13	47·18	7·12	..	..	..	..	..	..	..	..	..	8·0
Bijhra ..	8	11	..	2·7	6·4	..	..	..	..	..	..	..	..	..	..	..
Potatoes ..	86	5	..	..	3·16	6·3	21·18	24·17	4·13	15·15	5·6	3·17	..	..	..	..
Tobacco ..	41	6	0·5	..	..	3·18	1·0	14·10	14·11	7·2	..	..	..	..	..	..
Melons ..	43	15	..	0·14	4·2	13·9	5·2	7·3	7·1	6·4	..	..	..	..	..	..

The first point with regard to which information may be derived from these figures, is the number of waterings given to each crop. The total area under each crop that was irrigated at all, is shown in detail, divided into such portions, as were irrigated only once, or twice or thrice, and so on. By noting the column under which the greatest area is found, the number of waterings given in most instances for that year is ascertainable, and this number may be taken as the average number of waterings for that particular year.

Indian corn. The only year of the four in which this crop was irrigated was 1869, and even then most of the area irrigated received only one watering, while a very large proportion was never irrigated at all, the other three years none was irrigated. For all purposes of calculation then it is unnecessary to make any allowance for cost of irrigating this crop. This is the only rain crop that gets any irrigation excepting joar, grown for fodder, which is cultivated in almost the same way as Indian-corn.

The *rabi* crops—wheat, barley, gujai, and bijhra. On similar grounds it may be assumed that in 1869-70 and 1870-71, wheat received two waterings; in 1871-72, only one; in 1872-73 three; and that in the first three years the other three crops only received one watering each, but three in the last year.

Potatoes received nine waterings in 1869-70; eight in 1870-71; only five or six in 1871-72, and six in 1872-73.

Tobacco was watered eight to ten times the 1st year, eight times the 2nd year, six or seven times the 4th year. The 3rd year shows a large proportion watered only once, which is very exceptional. Melons were irrigated four to six times the first year; three times the 2nd, and four times the 4th. The 3rd year is exceptional with regard to this crop also. What is the cause of these variations? Nothing more than the variation in the rain-fall, as will appear from the following statistics of the rain-fall those four years. The rain-fall for the year is divided into two portions; the rains from June to October, and the rains from December to February.

Rain-fall at Fatehgarh.

		June to October.		December to February.	
1869	...	31¾	inches,	1½	inches.
1870	...	36½	,,	1¼	,,
1871	...	21¾	,,	3	,,
1872	...	31½	,,	0¾	,,

The irrigation of the Indian-corn is only affected by the regular rains and chiefly by the date at which they commence. It was observed that it was only in 1869 that this crop was irrigated; it was so only because the rains that year were late. In 1869 during June, only ·1 inch of rain fell, whereas in 1871 during that month 9·1 fell; in 1871, 5 inches, and in 1872, 4 inches.

The irrigation of the *rabi* crops on the other hand depends on the cold weather rains, and it will be seen the number of waterings given (especially to wheat) exactly varies inversely with the rain-fall. When the rain-fall was about 1½ inch, two waterings were required, 3 inches of rain rendered only one watering necessary; while a failure in the cold weather rains compelled the cultivators to water their wheat three times. As is natural, when the rain-fall is favourable, as the average number of waterings decreases, so also the area that is not irrigated at all, increases in proportion to the whole area. Thus in the first two years the unirrigated area was less than one-third of the irrigated area; in the 3rd year it was more than one-half, while in the 4th, there was practically *no rabi crop unirrigated.* The character of the rain-fall in December and January, thus materially affects the cultivator. As a general rule, two waterings from the well with the assistance of a moderate rain-fall are sufficient for the *rabi* crops.

Irrigation for potatoes also varies with the rain-fall in January and February and March. Hence the fact that eight or nine waterings were required in 1870-71, while six sufficed in 1872. In 1873, the small rain fall from December to February, would lead us to expect numerous waterings, but there were only six. This was owing to heavy rain-fall in March, 1873, during which two inches of rain fell, whereas in the other years there was less than an inch. Tobacco and melon irrigation commences in April and ends in June, during which the rain-fall is so small, that it does not affect the watering of these crops to any great extent.

The next point on which information is to be derived from these statistics is the time which it takes to irrigate an acre of the different crops.

The following are the figures :—

CROP.	NUMBER OF DAYS TAKEN TO IRRIGATE AN ACRE.			
	In 1869-70.	In 1870-71.	In 1871-72.	In 1872-73.
Wheat	..	4·5	4 4	4 1
Barley	..	5·0	4 8	4·8
Gujai	4·4	4 8	4 4	4 4
Bijhra	..	4·5	4·4	4 8
Potatoes	3 7	3·8	4 0	4 4
Tobacco	..	4·3	4·8	4·4

From this it would appear that *rabi* crops take about 4½ days to irrigate an acre. Potatoes are irrigated more quickly, an acre being watered in four days or even less. This arises from the fact that for potatoes the waterings are so frequent that the ground hardly has time to dry, and absorbing less water, is more rapidly irrigated. Tobacco waterings are equally frequent, and it might be supposed that the same would be the case with regard to that crop also ; as a fact however, it takes longer than most crops to water, probably because its irrigation takes place in the hot weather months, so that even the frequent irrigations it receives, are not sufficient to keep the ground moist.

Statistics of Ploughing.

Crop		AREA PLOUGHED.												
		Once.	Twice.	Thrice.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.
1869-70.														
Indian-corn ..	158 9	16 3	*91 1	51·0	12 16	4·3	8 1	..	..	..	..	..	.	
Joar ..	346 0	2·5	*182·16	101·2	1 17	..	..	..	..	..	.	.	..	.
Rabi crops ..	412 (	1 7	8·0	7 2	23 11	24·7	22 11	19 13	43·8	*84·18	63·6	45 10	43 7	24·19
Potatoes .	89 14	0 15	2·5	18 0	*24 16	10·17	12 1	..	..	..	..	..	..	..
Tobacco ..	4 2	5 17	9 16	*19·2	3 3	.	4·2	..	..	..	..	..	..	.
1870-71.														
Indian-corn ..	156 17	28 6	*97 15	22·15	8·1	..	.	..	..	..	..	..	..	..
Joar ..	308 11	26 4	*134·5	121·6	26 16	..	..	..	..	..	..	..	..	..
Rabi crops ..	394 12	3·19	14 5	24 0	28 9	35 8	15·1	39·5	47·4	43·8	*49·11	42 19	17 16	40 7
Potatoes ..	107 17	6 14	22 19	*44 10	23 4	8 10	2·0	..	..	..	..	—	..	..
Tobacco ..	[illegible] 4	11·11	*15·1	12·3	..	..	..	..	..	..	.	..	.	..

NOTE.—The figures having an asterisk before them, mark, in each year, the number of times each crop was most commonly ploughed that year.

Statistics of Ploughing.—Continued.

Crop.		AREA PLOUGHED.									
		Once.	Twice.	Thrice.	4th.	5th.	6th.	7th.	8th.	9th.	10th.
1881-72.											
Indian-corn	113 15	41·17	*53 2	14·8	4 8	..	..	..	..	..	..
Joar ..	283 13	84· 8	*118·13	70·1	15·11	..	..	..	..	..	..
Rabi crops..	42 16	25·16	95·14	*114·0	54·17	*17·7	10·13	..	..	..	..
Potatoes ..	78 17	*47 19	27·15	3·3	..	..	..	..	..	..	..
Tobacco ..	..	*11· 5	3·16	12·0	2·3	..	..	..	..	..	..
1872-73.											
Indian-corn	146 18	*73· 6	52 2	18·8	..	3·2	..	..	..	..	..
Joar ..	320 16	108· 9	*158·13	38 6	8·12	6·16	..	..	..	..	..
Rabi crops	391 7	13 17	86·13	88·14	43·7	*76·7	56·3	44·18	51·8	18·11	8·9
Potatoes ..	84 15	21·10	*4?·7	11·17	8·11	1 10	..	..	..	..	..
Tobacco .	41 6	8 11	*33·17	..	3·18	..	..	..	..	..	..

NOTE—The figures having an asterisk before them, mark, in each year, the number of times each crop was most commonly ploughed that year.

From these figures we learn :—

That for Indian corn the land is generally ploughed only twice, sometimes even only once, as in 1872-73, much indeed in any year received only one ploughing, the maximum number was six.

For joar, the number of ploughings is most commonly two, though a considerable proportion gets three ploughings, some lands as many as five.

For *rabi* crops, the ploughings are much more numerous. The maximum rises to thirteen, while the mean was nine, one year, ten the second : and five the third. In 1871-72, the most usual number was only three, and the maximum only six.

Potatoes generally require three or four ploughings, but sometimes receive as many as six . while in 1871-72, the usual number was only two.

For tobacco, two ploughings are generally enough ; sometimes as in 1871-72, the number falls to one. The maximum never exceeded six.

It will be observed that in 1871-72 nearly every crop received less ploughing than in any of the other three years. This was again the result of the scanty rain fall that year ; the soil was not sufficiently moist long enough together to admit of the usual number of ploughings, and no doubt the crops suffered for it.

From these returns has been calculated the time it took *one* plough to plough an acre. As a general rule, several ploughs work together: but in each case the number of ploughs at work was recorded, so that the calculation was simply arithmetical.

	NUMBER OF DAYS TAKEN TO PLOUGH AN ACRE IN.		
	1870-71.	1871-72.	1872-73.
Indian-corn	1·18	1·87	2·3
Joar	1·16	1·63	2·0
Wheat	1·5	1·27	1·74
Gujai	2·1	1·52	1·8
Potatoes	2·2	2 4	2 5

The figures for 1869-70 are imperfect, so that year has been omitted. Ploughing for potatoes is apparently done with greater care, and therefore more slowly than for other crops It will be observed that for every crop, ploughing was slower in 1871-72 than in the other years ; but I am unable to suggest any reason why this should have been the case.

The most interesting of the statistics still remaining are those referring to the system of a triple crop alluded to above. Under this system, which is very common in the villages in the suburbs of Farukhabad, the land is first sown with Indian-corn in June or July. This crop is harvested towards the end of August or in September. The field is at once ploughed up again, and, by the end of October or middle of November potatoes have been sown. This crop occupies the ground, according to the season, till February or March, again the field is re-tilled, and in the course of the month of April is sown with tobacco or melons, which crops are not cut till the end of May or June. There is then but little delay before the ploughing for the Indian-corn crop begins, and the same rotation repeats itself. It is clear that such a system as this requires a plentiful supply of manure ; and it is not surprising that such fields should commonly receive thirty tons of manure yearly. It is plain, too, that such a system could only flourish in the neighbourhood of a large city where alone the necessary supply of manure would be available.

It is not, of course, the case that the whole area under Indian corn is made to produce two other crops every year. A certain portion alone is thus highly cultivated, though nearly the whole produces a second crop. The following figures show to what extent the triple crop was grown during each of the four years.

First Crop.	Area in village bighas	Second crop.	Area.	Total.	Third crop.	Area.	Total.
1869-70.							
Indian-corn	164-5½	Fallow ..	3·2¾	3·2¾	Fallow ..	..	3·2¾
..	..	Wheat ..	13·8½				
..	..	Barley ..	38·17				
..	..	Gujai ..	6·13¾				
..	..	Bijhra ..	2 10				
..	..	Gram ..	1·0				
..	..	Tobacco ..	5·2½	66·11¾	Fallow ..	..	66·11¾
..	..	Potatoes .	87·13¾	..	Fallow ..	..	21·15¾
..	..	Carrots ..	6·17½	94·11	Tobacco	37·17½	
..	..	Total area producing a second crop		161 2¾	Melons .	34 17¾	72 15½
..	..	..	..	..	Total area producing a third crop.		72·15½
1870-71.							
Indian-corn	164-8	Fallow ..	..	1·10	Fallow ..	..	1·10
..	..	Wheat ..	2·0				
..	..	Barley ..	41·3				54 10
..	..	Gujai ..	8 14				
..	..	Bijhra ..	2·12	54·10	Fallow ..	..	
..	..	Potatoes ..	107·18	..	Fallow ..	..	22·0
..	..	Carrots ..	0·10	108·8	Tobacco	39 5	
..	..	..	..	—	Melons ..	47·3	86 8

First crop.	Area in village bighas.	Second crop.	Area.	Total.	Third crop.	Area.	Total.
1871-72.							
Indian-corn	141-6½	Fallow ..	..	1·8½	Fallow ..	..	1 8½
..	..	Wheat ..	1·16½				
..	..	Gujai ..	18·8½				
..	..	Barley ..	16·8¾				
..	..	Bijhra ..	14·9½				
..	..	Gram ..	0·19	51·16¾	Fallow ..	..	51·16¾
..	..	Potatoes..	85 9				
..	..	Carrots ..	2·12½	88·1½	Fallow ..	..	23·8½
..	..	..	..	..	Tobacco ..	35·18½	
..	..	..	..	..	Melons ..	28 19½	64·18
1872-73.							
Indian-corn	201-0	Fallow ..	..	6·13	Fallow ..	..	6·13
..	..	Opium ..	10 10¾				
..	..	Wheat ..	27·5¾				
..	..	Gujai ..	34·9½				
..	..	Barley ..	34 1½				
..	..	Bijhra ..	1·1½	107·8¾	Fallow ..	..	107 8¾
..	..	Potatoes ..	86·5				
..	..	Carrots ..	0·13½	86 18½	Fallow ..	..	1·7
..	..	..	..	..	Tobacco ..	41·7¾	
..	..	..	..	..	Melons ..	43 15½	85·1

From these figures we learn that nearly the whole area that produced Indian corn as a first crop also produced a second, the area that remained fallow after the first crop being insignificant every year. A considerable portion, however, yielded only a second crop. Thus in the first year a third crop was produced by 72¾ *bighas* out of 164½, in the second year by 86½ out of 164½, in the third year by 65 out of 141 *bighas* while in the fourth year the area fell to 85 out of 201 *bighas*. It is only after potatoes or carrots as a second crop, that a third can be grown Ordinary *rabi* crops occupy the ground too long, to admit of sowing tobacco or melons that year. These two crops, tobacco and melons, are the only two that are grown as a third crop. There are two tobacco crops, the other is grown during the cold weather months, but it is not common in villages such as Bijadharpur where by the rotation in use, tobacco can be grown in addition to two other crops.

(*To be continued.*)

MR. HARMAN'S REPORT.

Extracts from the Annual Report by the Superintendent of the Mysore Government Experimental Farm.

IMPLEMENTS.

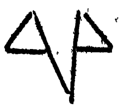
The English plough.—Since the beginning of June, implements which may be broadly designated as "English ploughs" have been in constant use on the farm.

As this is their first introduction into Mysore as implements to be worked by bullocks and ordinary coolies, it may be as well to briefly note in what respects they differ from the so called native plough. The cutting and penetrating part instead of being a point is an edge (the share) which is capable of renewal when worn out.

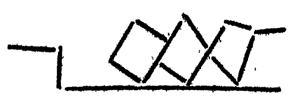
The body of the implement is furnished with a curved iron plate (the mould board) to invert the soil disturbed by the share and leave it on one side of the path of the plough. The depth to which it is desired to penetrate into the ground can be regulated.

The plough is furnished with a wheel, on which it can be moved from place to place as readily as is the native implement on a man's shoulder.

The difference between the work performed is shewn in the following diagram:—



No. 1. This represents the section of the earth through which a native plough has passed. It will be noted that the earth is thrown on either side of a traingular furrow, and gives an appearance of double the earth moved.



No. II. This diagram represents in section a piece of land ploughed by an English plough. It will be seen that the furrow is *rectangular* and thrown on *one side* only.

Further that the *whole* of the land passed over is *moved* and *inverted*; and the surface beneath the cultivated portion is *flat*, so that while an indefinite number of ploughings, lengthways, across and diagonally, are necessary with the native implement to obtain a given depth of throughly cultivated land, a better result is obtained by a single ploughing with an English plough.

To expose the maximum surface of inverted soil, the depth ploughed should be in proportion to the width as 7 to 10. To shew the quantity of soil turned over with a given depth of 5 inches, [illegible] in the case of the English tool, a rectangular section with sides of 5 and 7 inches which gives (748) cubic yards per acre turned over by a pair of cattle walking 14 miles.

If, however, it is desirable to lessen the distance to be travelled by the cattle, a nine inch furrow can be as readily ploughed, and the distance reduced to 11 miles.

The question as to which would be the more desirable, depends on the requirements of the case, and is one of the many minor internal points in farm management requiring consideration on the field.

To shew by an actual example the gain in time in getting in a crop of gram.

On August 19th after a shower of rain which had fallen on the previous day, a native plough attached to an ordinary pair of farm bullocks, and four English ploughs each drawn by a pair of similar cattle were started to work at 7 A. M. At 12 the work stopped until 2 when it was resumed and the piece of land was finished by 4 P. M. or in 7 hours.

During that time the native plough covered 749 square yards going over the ground twice before gram was sown, and once after to cover in the usual cultivation given for gram, and attaining a medium depth of three inches. The four teams worked English ploughs before sowing, then a bunch of bamboos as a brush harrow to cover in the seed, and got over 12,124 square yards ploughed to a medium depth of four inches.

The area sown was four to one in favor of the English implement and in addition it was cultivated one inch deeper. The land was a light sand, and had been untouched for years. Its regular shape was slightly against the English plough. The details of two adjacent patches measured when harvested are as follows:—

BY NATIVE PLOUGH—

Plot No. III—Previous crop none. Manure none. Soil light sand.
Broken up and sown by three turns of native plough.
Sown August 16th, harvested December 14th.

Kind of crop.	Area in decimals of one acre.	Produce in lbs.		Produce per acre in lbs.	
		Grain.	Husk.	Grain.	Husk.
Horse gram ...	·154	30	73	194·8	474

BY ENGLISH PLOUGH. Previous crop none. Manure none.
Soil light sand.
Broken up by a single English ploughing and the seed covered by a brush harrow made of bamboo twigs tied together.

Kind of crop.	Area in decimals of an acre.	Produce in lbs. per acre.		Produce per acre.	
		Grain.	Straw.	Grain.	Straw.
Horse Gram ..	·220	40	154	222·7	700

In this case the object was not to plough deeply, but to cover as much ground as possible so as to sow a large breadth of land, before the effect of the shower was lost. Had the character of the crop required a deep ploughing, the English ploughs could, if necessary, have gone down another two or three inches, but at the expense of speed; while no native plough can approach this power of penetration.

The next experiment made without reference to time, but with the object of testing the implements as crop producers, although giving miserable returns in both cases through the drought, yet unmistakeably indicates the superiority of the English implement.

PLOT NO. I. Previous crop none. Manure none.

Broken up as thoroughly as possible by several ploughings with native plough. Sown August 10th.

Kind of crop.	Area of Plot in decimals of an acre.	Seed sown in measures.	Produce in measures.	Produce per acre.
Black-gram ...	·197	6	·25	12·19
Karamani ...	·27	4	5·00	18·40
Green gram ...	·27	4	6·00	21·70

PLOT NO. II. Previous crop none. Manure none.

Broken by three English ploughings. Sown August 25th.

Kind of crop.	Area in decimals of an acre.	Seed sown in measures.	Produce in measures.	Produce per acre.
Black-gram ...	·4	11	9·25	23·12
Karamani ...	·5004	8	11 50	22·98
Green gram ...	·4	5	36·00	90 00

The second plot, although sown a fortnight after the other, gave an increase in the following proportions :—

Black gram	100 to 182
Karamani	100 to 130
Green gram	100 to 415
Mean	100 to 242

After the harvesting of the crops sown on the land worked with English ploughs, it was found sufficiently light to be ploughed again, without watering, and the notch grass, bullock grass and other difficulty killed weeds had become in a great measure extinct, or very much weakened. The other land was much in the same state as before breaking up, full of weeds and too hard to be touched by any implement.

The cultivation of dry land immediately after the removal of the gram crop is, I believe, a new system consequent on the introduction of the English plough, and has several points to recommend it. The chief one is, that it can be carried out at a season when work for cattle is not pressing and gives an opportunity for the sun, air and dew to act on an extended surface of earth during the hot dry months which here in some measure take the place of frost in England. The falling of chance showers of rain late in the season influences the depth to which this cultivation can be carried ; but even if only a two or three inches are loosened, an advantage is gained. It is, as it were, introducing the thin edge of the wedge, so that when the first rain falls, instead of meeting with a hard baked surface, over which it runs without sinking, it may at once find favourable conditions for penetration. Two or three inches, or perhaps more, of soft ground will retain the water sufficiently long for it to sink in and soften the layer beneath, so that ploughing operations can be commenced in a double layer of moistened earth instead of a single. This is a great gain in time ; for while the ryot is making his single layer fit for the reception of seed, the moisture has evaporated, and he has to wait for a second shower for sowing, but in the case of land ready ploughed, the seed may be planted with the first, and the rain having sunk more deeply is less subject to the influence of the sun. Besides this gain in time, earth, which has been exposed to atmospheric agencies, contains more available plant food ; that is the action of carbonic acid and water in the form of dew or perhaps in a chance shower of rain, working on the other constituents through several months, cause insoluble silicates which constitute the main bulk of a soil, to form more readily decomposable compounds. In a country like this where manure is so difficult to obtain at a rate sufficiently low to be taken advantage of by the bulk of the cultivating classes, attention to atmospheric influences is of permanent importance, for by them the riches already in the soil can, to a great extent, be unlocked. If the hitherto unused subsoil can, in addition, be, even to a small extent, exposed, prolonged fertility can be predicted.

The step which I am now advocating would be leading in this direction ; for having a soft bed to fall on to commence with, the rain would extend its action downward, and the cultivator without much additional labor can penetrate deeper than his former habit of waiting for rain permitted.

Softened earth gives still another advantage ; that is manure can be ploughed under immediately it is carted on to the ground and there lie uninjured. If left in heaps on the field, as I have occasionally observed it, there is such a pressure of work when rain falls, that it is almost impossible to spread rapidly enough not to be in the way of the ploughing, and then the heap gets trampled on by the passing teams and so disturbed that a subsequent even and wide distribution is impossible. There are manures which would not be applied to their greatest advantage by this method, but sweepings containing ashes, and the general debris of town or village which form a large proportion of the manurial materials now applied, would experience no loss.

The objections urged against the extended use of this implement deserve a short consideration, for although they are made by superficial observers they none the less require meeting. First is the primary cost. While it is I grant against general adoption by the poorest *ryots*, there are very many who if thoroughly conversant with the advantages it possesses over the old implement, would not find this objection insurmountable.

The error of considering this point alone is perhaps natural to the unprofessional critic who gives opinions on agricultural matters with decidedness which renders an explanation to his established but ill-grounded conclusions, and I feel it necessary to enter with some minuteness into this point in order that I may shew that the real value of an implement is not in a low primary cost, but the comparison of the work produced with the cost of production.

From the account kept of the work done in the implement workshop attached to this farm, I take figures which I believe closely approximate actual returns, and these extended over a period of ten years, the length of time a plough may, with proper care, be expected to last give a fairly accurate idea of the annual cost :—

To original cost				85	...	...
„ annual expenses—						
Blacksmith's wages for 2 days at annas 8 per diem	1	0	0			
Bellowman's wages for 2 days at annas 8 per diem	0	8	0			
Charcoal and husk	0	8	0			
Iron, 3 seers at annas 12	2	4	0			
	4	0	0	89		
To occasional renewals of parts—						
Two new slades at annas 12				1	8	0
Two new wheels at Re. 1 each				2	0	0
One new mould board				3	8	0
Contingencies				1	0	0
				82	0	0
Deduct value of implements as old iron at end of 10 years				5	4	0
Total ...				76	12	0
Annual cost				7	10	9

It is more difficult to arrive at the cost of renewal of the parts of a native plough, but any one who has seen one at work is aware how frequently stoppages occur from breakages. From my own observations and by enquiries from those likely to give reliable information, I believe I am not far wrong at placing it at from two to four rupees a year.

The value of the time lost by breakages, it must be remembered, is considerable, for, they occur just at the busy season of the year, and during the very limited time the land is in a condition to permit of cultivation by this implement, so that if we estimated the cost per working day, very different figures would be arrived at.

Now to review the respective out-turn of work from several standpoints.

Firstly the amount of work in a given time.

The measurements I have previously given shew the proportion to be one to four on sandy land, but this is, I think, a greater difference than would occur taking the year through, and I would rather adopt one to three from my experience of the daily work done on this farm on all varieties of soils. Under these circumstances two courses are open to the possessor of the English plough. Either to increase his area of cultivation three fold, or reduce the number of bullocks from three pairs to one, accompained with a corresponding reduction in ploughmen. If he have but one pair of bullocks, he must be prepared to feed them in a more rational manner than is usually adopted, but with the deeper cultivation increased productiveness may be looked for, as shewn in the experiment of English *versus* native ploughing for the various grains.

Secondly, the lightness given to land by the English plough permits of the extension of time during which the land may be worked after the removal of crop, and places the atmospheric advantages I have pointed out at the service of the succeeding one, a residual effect not attainable by the other plough. Thirdly, the English plough performs several operations which a native plough cannot attempt. For instances, ridging can be brought to as great a perfection by manual labor, and with the introduction of this method of cultivation, garden crops necessarily grown over limited areas from the time and expense taken up in planting them, can be extended over sufficient ground to be classed as farm crops.

Garden crops are, as a rule in India, grown with more manure and by better methods than ordinary field produce, and anything tending to extend a higher class of cultivation over a more considerable area than it now occupies, may be regarded as advancing the agricultural condition of the country.

The second objection brought forward is that the ordinary working cattle of the country are neither sufficiently large nor strong to drag an English plough. This has also a certain amount of truth in it. Undoubtedly the miserably fed and stunted beasts so often seen could not drag a plough turning a nine inch furrow, but the depth to which a plough can penetrate can be readily adjusted, and if only worked for a third of a day as much land would be ploughed as with the native method, and in a far more complete manner.

The maximum amount of utility would not be got out of the plough under these conditions ; still it would be serviceable.

Then again many of the ryots with a little means use very fair bullocks, and if the demand for the heavy animals such as are most suitable for the work were created, it would give an impetus to the breeding of first class cattle.

As the English plough turns over such a much wider and more complete furrow than does the native tool, the quick pace at which the cattle are driven when yoked to the latter need not be attained, and slow work being less exhausting than quick, the number of hours during which work may be performed can be extended without additional fatigue to the cattle.

As this is the first season of their employment here, I have been brought face to face with the difficulties that would present themselves to the ryot, supposing the two chief ones already mentioned to have been surmounted.

The first is that the cattle require a certain amount of training to teach them to walk straight, which is a point of the utmost consequence to good ploughing. A pair of cattle which have been accustomed to plough are very liable to swerve, should the pressure on the yoke suddenly increase by the plough encountering a hard piece of earth. They can be broken of this by a little careful driving, and after a month or so of regular work give little inconvenience to the ploughman.

Another objection, and I can consider it a great one, is that the ploughman must pay attention to his work, and be constantly on the alert if he desires to turn over a proper furrow. If care be not experienced to plough straight and keep the furrow well shaped, patches will be left here and there unploughed, and a cross ploughing must be given to obliterate them. The difficulty of training both cattle and men simultaneously, has been got over by allowing a couple of men to work for a few days with a plough and a pair of cattle, the one driving the cattle and the other guiding the plough.

Although the work performed is still rough, many of the men on the farm understand the implement and how to work it, and can plough and guide their cattle at the same time.

A certain amount of harm might be done by introducing these ploughs and sending them into the district to be drawn by untrained bullocks, and worked by those who have never seen them before. Nearly every new cooly on this farm, the first time he is set to plough, will, if let alone, set his plough to plough as deep as it could go under the most favorable conditions, irrespective of the condition of the land. The consequence is that the bullocks are unable to pull, turn sharp round, get excited and become unmanageable, and instead of drawing steadily, pull in spasmodic jerks. This puts undue strain on the plough, and the share being of malleable iron may bend a little and increase the resistance, and affairs proceed from bad to worse until finally, if let alone, the implement would be abandoned as too heavy for bullocks to pull.

A day's training given to a man by putting him into a field which has already been ploughed, and then letting him set his plough in every possible way, readily overcomes this difficulty, and when once a man has learnt how to set his plough correctly, he finds it less fatiguing to work than his own native tool, and the bullocks feeling, the resistance behind them giving way, soon pull with the required steadiness.

There are of course many little points to be learnt only by lengthened experience before a man can become a first rate ploughman, but with moderate attention, only a short time is required to master sufficient of the principles under which the machine is worked, to avoid all chance of strain to the cattle, or injury to the plough.

I have mentioned the share being of malleable iron. This is purposely the material employed as it is such as the village blacksmith uses, and the power of making a new one when required is thus placed within his reach, so that this, which is the chief article requiring repairs, can be readily put right in however remote a district the plough may be.

Hoes.—A few hoes of various weights, made in the implement work-shops, have been employed to a considerable extent. The chief advantage they represent is the quickness with which a cooly using them can weed crops growing in drills, and although the work they perform is not so perfect as that of a *kuddali*, yet at certain seasons of the year, it is more important to check the weeds growing over a large area, than root up a few square yards of ground.

A second purpose to which they are applied is the earthing up of maize, potatoes or other corps in trenches, so that water, which in the earlier stages flowed directly over the root or seed, may, when the plant is sufficiently grown, pass midway between the rows. During the first few days these tools were used, the coolies found them tiring to their arms and backs, but the fatigue soon wore off, and I believe they now take to them, as a matter of course, and allow their utility for the sepecial purposes to which they are applied.

A demand for these has sprung up, and some of my neighbours purchase from the implement work-shop.

MAIZE.—

Mokka Cholum and Indian Corn.

The growth of this crop during the past year has been most successful, and successive crops have been taken throughout the year, by means of well irrigation.

As a great demand exists in Bangalore for the cobs while in a green state, the usual plan adopted has been to dispose of these when ready, and reserve the fodder for the use of the working bullocks.

The variety most largely grown is from seed obtained from the Madras Government Farm, and imported previously from Australia. Of other kinds a local variety, Arcot, Sweet-white table, and American flint, have also been sown. As the lands on which most of the crops have been grown during the past year, have required extensive levelling to bring them into a state that the wells might water a maximum area, any returns of experimental culture would be unreliable at present; but I give the gross results of two crops.

PLOT NO. 4. Crop, Queensland maize; grown from seed which had been raised on the Madras Government Farm.

Area, .415 acre; Land, first rate garden loam; Irrigation, ten waterings from a well chiefly while the plants were young.

Cultivation.—The land was first softened by a watering, and dug over two days afterwards by *kuddalis* to a depth of about eight inches and carefully weeded. Town manure at the rate of 12 loads per acre was then applied, and the land ridged in rows two feet apart. The seeds were sown down the furrows, so as to facilitate watering at a depth of two inches, and a foot distance from seed to seed. In a month the plants were about ten inches high, when a slight top dressing of village manure, about five loads per acre, was given, and the land thoroughly hoed between the ridges. Two days afterwards the soil was earthed up round the young plants, so that what was previously the ridge became the furrow. The object of this was to support the plants so that they were less likely to be blown down by the wind. The cobs were ready in three months and were sold by public auction on July 26th for Rs. 26 or at the rate of Rs. 62-10-0 per acre. The yield was at the rates per acre of—

Green cobs 6 291lbs.
Fodder 14,894lbs.

The cobs averaged 261 to the hundred-weight, some weighing as much as 1 lb. 2 ozs. each.

Both in this and subsequently grown crops of this variety, most of the plants have thrown off from two to six cobs, but they do not all come to maturity.

On several occasions I have plucked off the tips of the cobs just as the flower appeared so as to destroy all chance of fertility, and the result has been that rows on which one or at most two cobs were permitted to mature have yielded the same weight of cobs as those which were untouched. The superior fulness compensating for the smaller number in weight, and the size securing a higher price.

Plot No. 5. Area, ·52 acre. Grown on good garden soil without irrigation. Planted June 15th, and received a similar cultivation to plot No. 4. Green cobs sold September 15th for Rs. 64-8-0, or at the rate of Rs. 124 an acre.

The cobs averaged 125 to the hundred-weight, and the crop gave a total yield at the rate of—

Green cobs 14,277lbs.
Fodder 10,680lbs. cut and weighed one week after removal of the crop. This fodder not being required at the time, was thoroughly dried so as to be stacked for use during the hot weather. When dry it gave a weight equal to 2,880lbs. per acre.

The growth of such a crop as this without irrigation, and with such a scanty rainfall, is most encouraging, even when considering the advantages it received from good land cultivation: but I hope during the next season to grow it as an ordinary field crop, now that the English ploughs are available.

It is unfortunate that the ripe grain is ignored as an article of diet in this part of India. It is, I believe, largely used in the North and its consumption in America and other countries is enormous. Perhaps the crop has not hitherto been grown on a sufficiently large and cheap scale to offer an inducement for the ryot to overcome his prejudice to trying a new crop, or it may be that no common method is known by which the grain can be secured from the attacks of insects.

MR. J. B. LAWES ON AGRICULTURAL CHEMISTRY.

MR. J. BENNET LAWES well known in agricultural circles delivered lately a lecture at Haddington on "Chemistry in its relation to Agriculture," more especially the connection between farm-yard manure and the various artificial compounds.

Mr. Lawes began by stating that many years ago a friend of his took up the subject of agricultural chemistry, but after a time abandoned it for some other pursuit, the reason for his change being, to quote his own words, "agricultural chemistry was nothing but ammonia and phosphorus." He was rather afraid that after hearing what he was about to say they would on their return home, if questioned on the subject, give the same answer. Chemistry in its application to agriculture, was one of the most modern of sciences, if a subject of which so little was really known had any claim to be called a science. The manuring of land was, however a very ancient operation, and would be found mentioned in the writings of Greek and Roman authors, but to define what a complex body was—to separate its constituents and define the part played by each in the growth of crops was a thing that owed its introduction to the present century. Artificial manures so far as they related to the present had their origin so recently, as to come within his own recollection. Before they could thoroughly understand the action of the common manures on the farm, they would require to know something of the substances of which these manures were composed. That there was much yet left to be learnt with regard to the common manures, they were well aware, and there was no one more ready to confess his ignorance than the person who now addressed them. He knew that he had before him a body of agriculturists, who had earned a high reputation for skill and ability, but he did not despair of being able to add something to the knowledge which they already possessed. He proposed to show the composition of farm-yard dung, the constituents by which it fertilised their crops, the lasting properties of the bulky manure, and how it was enriched by purchased food, and the connection between farm-yard dung and the artificial compounds. He would refer to experiments which had been carried on for a long time on his own farm at Rothamsted, which had occupied a deal of his attention, but he knew if his calculations did not appear to be justified by the evidence he would place before them, they would not hesitate to reject them. Let them assume the case of a farm of 400 acres of arable land, with four course rotations. The straw was consumed in the yard—one-fifth by stock and four-fifths as litter. The food and litter of that farm would give 840 tons of dung, or, if they deducted water, 242 tons. How was this quantity made up? Nearly four-fifths of the whole was made up of straw, and this straw must form a large proportion of farm-yard dung, when they considered the amount of food consumed by animals and what was required for the processes of respiration. By the table No. 1 on the wall (given below), they would see what was the average composition of the whole of that dung. He left out unimportant substances in the estimates submitted, and had simply given the three substances of most importance—potash, phosphate of lime, and nitrogen. The figures given had not been arrived at by practical analysis, but had been calculated from experiments, and were closely confirmed by several analyses of farm-yard dung. Professor Voelcker had told them in what state of combination these substances were, and had shown them to be in great part very insoluble, so that plants could not get hold of them until they went through further changes of soil. Of nitrogen, 14lbs. was about equivalent to 17lbs. of ammonia, and only 2½ of that was in the form of salts of ammonia, or the active form of ammonia. They all knew about soluble and insoluble phosphates—he supposed there was hardly a farmer in Scotland but knew as much about these as he did himself. But what of soluble and insoluble nitrogen, which was a much more costly thing? The gentleman who closely analysed chemical substances, telling them all about them with an accuracy that was astonishing to a scientific man, told them nothing of these. They were content to turn these into ammonia, under the designation "yielding ammonia," leaving them in a happy state of ignorance as to when such changes took place in their soils. Here straw occupied a very large place, and he proceeded to show what straw did for crops. On two pieces of land, half grass and half permanent pasture, they had applied at Rothamsted an equal amount, one receiving 2,000 lbs. per acre of cut wheat straw. Several years elapsed before any action was visible, but a combination had at length taken place, and during the last ten years the crop had amounted to 11 cwt. of hay per annum. On a field of permanent barley they found by experiments that not more than 6 quarters per acre could be grown, because if they tried to increase the crop beyond that, it, to use a common phrase, "runs to straw." And to grow 6 quarters of barley they had every year to use a considerable quantity of soluable ammonia. They required to have 50lbs. of soluable ammonia, or some equivalent of nitrate of soda. Of farm-yard manure they required 250lbs, because that substance was in an insoluble form. He next referred to a field lately brought into potato cultivation, which had been for twenty years under manure, and the produce of which exceeded that of the manured land by 8 cwt. In another field they cut off about an acre and left it in manure. After a lapse of fully 25 years the careful observer could still see slight indications of where the previous dung had been. Dung exercised a much greater influence on crops than was generally supposed. It acted first of all by supplying a large amount of matter in an insoluble state, hence its lasting properties were very great. Probably part of the dung applied on the first day of entry on a farm might form part of the crop at the end of a nineteen years' lease. What were the manurial properties of dung? Was it possible that the sole manurial properties of that dark mass of strong smelling substance they called farm-yard manure were due to chemical salts? and was it true that plants preferred their food in that form? He wished them to assent to this if he proved to their satisfaction that the organic matter which constituted so large a proportion of farm-yard dung, did not act as manure. If the organic matter of crops was derived from the soil, then they must depend on the stores accumulated by previous dunging, and artificial manures would consequently have a much more limited application. The question was undoubtedly one of great importance, as 90 to 95 per cent. of their crops consisted of organic matter. If, however this matter came from the atmosphere, and not the soil, then the connection between farm-yard manure and the other kinds of manures was much closer than was generally admitted. He referred to table No. I (annexed) showing that organic matter and water left but a small residue of farm-yard manure, and remarked that the question arose, when they applied a substance which did not contain organic matter and increased their crop was that increase made at the expence of organic matter, or was it utterly independent of that? That was a question which could not be answered by one or two experiments. But suppose they were to make an investigation, how would they go about it? Well, as dung contained a great deal of organic matter they might keep an acre always in dung and another acre always in manures which did not contain organic matter. Suppose they did this, how long would it take to decide whether the organic matter did or did not tend to help their crops? Assuming that the crop with chemical salts was always big or bigger, than where these were not employed, some might say five years, and others might give ten years, as the period that would have to elapse. But he dared say the most sceptical of them, if they saw year after year a crop as good, whether these were put on or not, would be satisfied that putting on organic matter did not help their crops. The experiments he now referred to extended further back than nineteen years—in one case to nearly double that space of time. He would read an account of what had been done at Rothamsted bearing upon the points referred to. From one acre of land produce had been removed where organic matter was applied each year in manure and where there was an absence of this, as follows:—

		Last year when dung was used.	Produce in 1876 with dung each year.	Produce in 1876 without organic matter in manure.
Wheat	...	30 yrs. ago.	1 ton 13 cwts	2 ton 12 cwts.
Barley	...	30 „	2 „ 12 „	2 „ 7 „
Mangold	...	34 „	19½ „ 0	25 „ 0
Pasture	...	22 „	2 „ 1 „	3 „ 12 „

In all these cases the evidence would be seen to be exceedingly strong in favour of the view, that plants did not take up their organic matter out of the soil at all. Possibly there are quantities of mineral matter that could be taken out of the soil every year, but it was obvious that a very large quantity of matter came from a source not supplied through the soil, and he thought they might safely conclude that the organic matter in dung did not act as a manure at all. What, then, were the functions performed by organic matter? It they referred to their garden soil, they would find it far superior to that of the farm, but then gardens received manure in a way which they, as farmers, could not apply it, and gardening and farming must be held to be quite distinct. At Rothamsted there was a wheat field which for three years in succession had received 14 tons per acre, yet it could not be compared to his garden soil. With reference to the enrichment of dung by artificial food, they had to look at quality not quantity, bearing in mind the great amount wasted in respiration and the quantity stored up in the animal. Some fifteen years ago he prepared and published a table regarding the manure properties of the different kinds of purchased food and their commercial value, but the table was not much regarded at the time, as indeed had been the case with many things of his. It had, however, received some attention on the passing of the "Irish Land Act" and the "Agricultural Holdings Act" and about a year ago a member of the Royal Agricultural Society of England introduced a proposition that a grant of money should be made in the interests of farmers with a view to conduct experiments for testing the value of the figures he then gave. The matter was ultimately referred to a chemical committee, and farmers, land-owners, and scientific men were examined. The result was that they agreed as to the desirability of conducting the proposed experiments, although it was deemed improbable that farmers and others not accustomed to make investigations of the kind, would be able to prove whether these figures were correct or not. The Duke of Bedford offered a farm for the purpose of making the investigation, but further examination showed that the field was not suited for the purpose whereupon the Duke allowed them to select any farm they might choose on his estate. They at length obtained 27 acres which were suited for these experiments. To a depth of about six feet the soil appeared to be nothing but sand. The experiments in progress were first of all the devoting of 16 acres to rotation experiments with the different cattle foods. Manure equivalant to cake and corn had to be supplied in artificial compounds (in conformity with the tables already referred to) as follows:—

	1000 lbs. of cake.	1000 lbs. of maize or Indian corn.
Bone ash	100 lbs.	16 lbs.
Sulphate potash	62 „	7 „
Sulphate magnesia	65 „	11 „
Nitrate soda	361 „	76 „

If there was any truth in chemistry, they ought to arrive at very important results from these experiments; but the results themselves were a question of time. Referring to the action of potash, phosphate of lime, and nitrogen on the soil, he said the two former entered more quickly into combination with the soil, and were taken up by plants with great ease. For the last thirty years he had observed that they had never descended into the subsoil at all, the first nine inches contained them. It was very different, however, with nitrogen, soluble nitrogen, salts of ammonia, or nitric acid, which was its ultimate form. They had no combining power with the soil, and the water from wells and rivers over England and Scotland, had always been found to contain more or less of nitric acid. It was not to be wondered at that their loss here should be immense, some of which they might arrest, whilst it was impossible to arrest other portions of it. With regard to the action of these very important substances, he referred them to table 2 (see below). If they wanted to grow grain by dung, they must use a great excess of potash, in order to get it to act properly—it would not do merely to allow one ton of farm-yard manure to one ton of cereal. As a great number of the farmers in Great Britain exported from their soils hardly anything else besides grain, they would see what an immense boon the introduction of guano was. Sometimes, however, they exported other substances besides grain, and as he was now in a potato-growing district perhaps he ought to refer to this particular kind of produce. The potash of one ton of potatoes and that in one ton of dung represented each other very closely. Yet although a ton of grain was a fair crop off an acre of land, a ton of potatoes was nothing at all—they would expect to have eight or nine tons. Therefore on an acre of potatoes he would say they should put 96lbs. of potash. They would see that they could not use guano so liberally on potatoes as they could on grain, because of the excess of potash which they had to deal with. It had been clearly demonstrated that the bulky manures were always good where they exported from the soil root crops, and although purchased dung would be dear to grow grain with, it was very cheap in the case of potatoes, potash forming a large item in grass and roots of all sorts. Wherever they exported root crops they must largely depend on the bulky manures unless they chose to buy potash. At Rothamsted they had grown barley 25 years in succession, and the results of the produce were 48⅜ bushels of grain and 29¼ cwts. of straw, where superphosphate and nitrate were used, as against 48¼ bushels grain and 31¾ cwts. straw, where potash had been used. Potash if anything gave the smallest grain produce, but, on the other hand, they got 2 cwts. more straw. On some soils it was nothing but a waste of time and power to put on potash, and they must always be guided by what was to be exported from the land. Referring to table No. 3, he pointed out that artificial manures contained the following substances:—Nitrogen, as ammonia or nitric acid, phosphoric acid, soluble and insoluble, in combination with sulphate of lime, and but rarely potash. These artificial compounds were found to act as stimulants, supplying certain necessary ingredients to crops, and also enabling crops to gather up manure out of the soil, which would otherwise be wasted. Mineral superphosphate of lime, or what they called bone—burnt bone decomposed in phosphoric acid—supplied soluble phosphoric acid and gypsum. This had been used alone on land at Rothamsted for the last twenty to thirty years. In permanent root crops it was found that dung alone gave better results than dung and superphosphate. On permanent pasture the average of twenty years showed that not more than 1 cwt. of hay per acre was due to superphosphate. In the case of permanent wheat and barley, not more than from 3 to 5 bushels increase was attributable to superphosphate. It was only when they came to rotation that they saw the effects of using superphosphate. He then referred to the results of a thirty years' rotation of swedes, barley, beans, and wheat, with red clover instead of beans twice in the thirty years. The roots were consumed on the land without any other food. One rotation was unmanured the whole time, and in the other mineral superphosphate was added to the root crop every four years. The last produce of the four crops now beginning the eighth rotation was as follows:—

		Unmanured.	Superphosphate.
1876-7.	Swedes	1 ton	11 tons.
1875	Wheat	19½ bushels.	31½ bushels.
1874	Red clover	1 ton 8 cwts. hay.	3 tons. 2 cwts. hay.
1873	Barley	23 bushels.	29 bushels.

They would observe that the effect on red clover had been marvellous. The unmanured plant covered the ground yet had no means of growing and those grown with superphosphate trebled the crop. It might be partly accounted for by the fact that phosphates with soluble lime very much extended the roots, and during summer and autumn they picked up a good deal of food in the soil which would otherwise be washed out by winter rains. So far as this kind of produce was concerned, the idea that the crop took its ammonia from the atmosphere (which he was sure was not the case) was contradicted by the crop deriving food from the soil which was liable to be washed away by rains, while also laying hold of what was not so washed away. Root crops were very exhausting to the land; indeed his experience went to show that they were the most exhausting of all kinds of produce. The great difference between the clover crops and the slight difference noticeable in the bean crops were not easily explained, and it was not yet known how the leguminous plants took up their food. Speaking of the action of nitrogen, he observed that this could not accumulate largely in the soil and be in a state of activity. Mineral manures, however, increased crops by enabling plants to gather up nitrogen from the soil which would otherwise be wasted, and nitrogen in manures added to the stock of nitrogen in the soil thus assisting plants to obtain fresh supplies of food from the air. He then submitted the following general conclusions arrived at by experiments:—1. That a [illegible] superphosphate of lime has given a considerable increase in each [illegible] of a rotation, although used without any other manure, for a period of thirty years. 2. That in consequence of grain containing large quantities of nitrogen and phosphoric acid, and small quantities of potash, manures containing soluble phosphoric acid and soluble nitrogen, as ammonia or nitric acid, are especially applicable to these crops. 3. That when crops containing large quantities of potash, such as roots, potatoes, and hay, are sold off the farm, manures containing potash, such as purchased dungs, appear to be more suitable. 4. That although potash, phosphoric acid, and nitrogen are the chief manure ingredients in farmyard dung, the manure from artificial foods and in artificial manures, still the differences in form in which these substances are met with, greatly affect their value; the present method of analysing manures does not properly recognise these distinctions, and the valuations founded upon these analyses are altogether false and erroneous.

Discussion having been invited,

Mr. HARVEY, Whittingham, observed that in that part of the country they had great difficulty in growing a bean crop without farm-yard manure—a circumstance which Mr. Lawes might be able to explain.

Mr. LAWES, in reply, said he had been silent on the subject of these crops, because he was very ignorant about them. It was not because he had not tried to grow them, for he had spent the best part of his life trying to get a clear knowledge of how these substances take their food out of soil, and he was almost as ignorant now as before. At Rothamsted they had, he dared say, spent £10,000 in this investigation, but they could not put their hands on their substances which this crop took out of the soil, particularly red clover. They had had beans under experiments for thirty years, but could not produce what they would call a big crop, and still less of red clover, by means of a chemical compound. When they did discover the secret connected with the growth of this crop, it was not probable that it would be in the form of a manure which they could purchase and apply. It appeared probable that certain changes took place in the soil during long periods, and substances were formed, the composition of which they did not know. That would be seen by his reference to the thirty year's rotation; still he could offer no solution of this difficulty. He was obliged to say he knew nothing about the growth of bean crops.

Mr. CHRISTIE, West Mains, submitted in the absence of Mr. Paton Standingstones, a series of questions on paper for Mr. Lawes to answer.

The CHAIRMAN remarked, with reference to the growth of beans, that it would be well if they could know why beans were not grown so well now as thirty years ago. He recollected beans grown on his farm in the Abbey, which were the pride of his father (who, considering that he was an old soldier, was as good an agriculturist as most). Those beans were 6 feet in height, and one was lost almost in going among them. They were, moreover, podded from top to bottom, and they were considered the best in the world.

A VOICE—It would not have carried that every year

Mr. Lawes said these leguminous crops had an aversion to ammonia, but did not dislike nitrate of soda so much, and he believed the use of ammonia might have something to do with the fact of their not now growing bean crop so well.

Mr. SMITH, Whittingham, said his experience of beans went to show that they got a better crop of beans where the straw was in medium quantity than where straw was very luxuriant.

Mr. LAWES then replied to the question handed to him on behalf of Mr. Paton, Standingstones. The first was whether Mr Lawes could tell, why superphosphate grows turnips, and even potatoes, so well in many parts of England, when they in East Lothian, with what might be said to be much better or richer soils, found that it did comparatively little good? They would observe that he had almost answered that question in relating his experiments of the great results from superphosphate on land never dunged. When they had put a quantity of dung on roots every year, superphosphate had done rather more harm than good. The higher they farmed in rotation, there was the less necessity for superphosphate of lime which enabled plants to gather residue from a soil when it would otherwise not obtain the residue. Superphosphate of lime had been the making of Cornwall for example. With corn after corn, and corn after corn, they would find it very valuable to gather and utilise a quantity of soluble ammonia or nitric acid. They would obtain a better crop from superphosphate of lime and nitrate of soda than from soda only. The second question was—Can Mr. Lawes give us a reason why in this county, even on the superior or richer soils, a mixture of nitrate of soda and superphosphate—analysing the same as Peruvian or Ichaboe guano—does not give such good results as the latter? Mr. Lawes said he was not sure that this was not due to the superior qualities of nitrate of soda, which, however, required great care in its use. From its extreme solubility it was apt to be washed away and was apt to overgrow their crops unless carefully used, though one of the finest manures. Their crop must, he thought, take the bulk of its food as nitrate of soda in some form, because ammonia did not diffuse through the soil until it became converted into nitric acid. Ammonia combined with the soil, but plants could only get hold of it when close to it, and directly it got converted into nitric acid, it went all over the soil. More experience in the use of nitrate of soda would probably make them think better of it. At Rothamsted, where both kinds had been tried, they preferred nitrate of soda to ammonia, as givi[illegible] crops whether of roots, grass, or corn. The third and last que[illegible] the paper submitted was—Seeing that no manure has yet bee[illegible] to equal guano, for the stronger soils of East Lothian, and [illegible] manure is always getting scarcer, what would Mr. Lawes recom[illegible] the best substitute, bearing in mind that superphosphate is of c[illegible]tively little value on the soils of East Lothian? That quest[illegible] Lawes remarked, was almost answered in what he had just sa[illegible] long as they could get guano with 10 or 15 per cent. of ammonia th[illegible]uld not have much better manure than that—the only fault was that very little could be got containing that quantity. They might get one, two, three, and twelve per cent. of ammonia, every cargo varied, and it was a question what they got. If they went to artificial manure of some sort they must resort to nitric acid, which was a very forcing manure, and must be used carefully. He could not, however, say what the results in their case might be.

Mr. STEIN, Broomhouse, understood Mr. Lawes to speak of the special necessity of a large quantity of farm-yard manure being used for potatoes. There was a practice occasionally tried in that county (where potatoes were [illegible]at value), whereby [illegible]ey grew turnips, ate them all off the field [illegible] then took potatoes, with the addition of some artificial m[illegible] He desired to know how that would affect the fertility of the s[illegible] or how it could be maintained in the frequent recurrence of such a course of cropping?

Mr. Lawes replied that when a crop of roots was thus eaten off the land the export was small, and they had afterwards pretty much the same substance. A great deal depended on how they manured their turnip crop. With a late dressing of superphosphate of lime they might not perhaps have enough potash to carry them through, and as a rule, whenever they exported root crop from the soil they must look to potash as being an important item, whether in the form of dung or in artificial manures. Unless the soil was of a very rich kind, they could not trust to anything like guano, and they had to guard against a loss of ammonia, which was liable to be washed away by winter rains. He was quite sure, from his own experience that he would grow as big a crop and bigger than they did without ever putting on dung. It was not a question whether they could do this or not, but whether it would pay them to do it. Potash was not a very dear thing to buy, but it might be a question whether it was economy to buy dung. Dung would be dear for some crops and cheap for others—dear, if they were to grow only corn crops, but possibly cheap with root crops if these were to be sold. It was simply a question as to what was economy in agriculture, and without a special case a general opinion on the matter could not be given.

Mr. RICHARDSON, Morham, Mains, referring to the danger alleged to exist as to the mixing of nitrate of soda and superphosphate, desired to know what would be a safe plan of mixing in view of the chemical change which took place?

Mr. LAWES referred to two plans for doing this. In the case of barley, the whole of the manures, superphosphate of lime and nitrate of soda were mixed and thrown over the land, before it was ploughed. That plan was the one first adopted, and it had been continued at Rothamsted, as they did not like to alter anything so as to destroy the harmony of the experiments. On his own farm he mixed superphosphate and nitrate of soda, and sowed them broadcast behind the drill.

Mr. RICHARDSON asked how long the ingredients lay mixed before being used?

Mr. LAWES said they were generally mixed as they went round to the field. It was not safe to mix large quantities together, however, he had never known of combustion, but he should not like to mix 100 lbs. together in case of producing what was called spontaneous combustion. In farming light land with a rocky sub soil, there was a danger of a lot going off by washing. With sandy or shallow soil, he preferred to wait until the crop was fairly growing before adding nitrate of soda.

Mr. ROBERTSON, New Mains, asked what class of land Mr Lawes experimented on.

Mr. LAWES stated that it had a sub-soil of yellow clay, below that about 9 feet being chalk.

A VOICE—Does Mr Lawes approve of covered courts?

Mr LAWES—I approve of everything that saves manure, if that is the object, no doubt covered courts would ensure a great saving of straw and a great saving of manure. The more they economised in this respect the less they needed to buy; there could be no question as to that.

A question was asked as to the relative value of ammonia from phosphates and coprolites. They had been given to understand that their chemical value was the same, but practically it had been found that ammonia from phosphates was the more valuable of the two. The source made a great difference in the money value of the article, and many were perplexed to know whether they were better to invest in the cheaper phosphate or in the more expensive one.

Mr LAWES said it would probably occupy them a whole day were he to give them the different sources of ammonia. It assumed exceedingly different forms of solubility, and it was highly unsatisfactory for any one merely to put this substance into a red hot tube and say it yielded ammonia—it might yield this 20 years hence. Some of the forms in which it occurred, never yielded ammonia till after a lapse of about eight years; others yielded it the very next day, and some within 24 hours. It was obvious that the form in which ammonia could be more quickly had was more valuable than that which did not yield it for several years. As time was of great value to them, this was a very important consideration. All these substances, however, had their value and no human being had been able accurately to estimate this value, because he did not know when it would come out. Rape cake he had found to operate quite as well as the salt of ammonia, and he had used it for barely anything these twenty-five years. It decayed rapidly, and they got out the ammonia at once, but they could not say this of every substance. Bones, again, on some soils never decomposed, whilst on soils of a different character they discomposed as rapidly as sugar in water. Guano, too, was a substance affording a ready form of ammonia and, like salts of ammonia or nitric acid, had a higher value than substances that were slowly formed. Dung, he pointed out, had not a higher value than artificial compounds that make dung, and they would give more for the three substances potash, phosphoric acid, and nitrogen than for dung. They did not value dung merely for the sake of price, and they knew that if they put on dung they must use a great deal more of it, because they could not get its constituents to come out as readily owing to their insolubility. It was a question not settled yet whether when these substances were added in dung, or added in chemical [illegible] representing dung, the ultimate crop would be bigger in [illegible] e than in other. They could not tell which yielded most or [illegible] ere was the greatest loss. The first crops would be better [illegible] the chemical manures went, but he believed [illegible] otwee the hare and tortoise, they would not be [illegible] stion at first, and might have to wait for a lapse [illegible] which ingredient yielded most.

In reply to a question whether soluble [illegible] from a mineral source or bone.

Mr **LAWES** said bone-ash was a mineral phosphate, and nothing [illegible] He would not make a distinction between them, they could not consider that a bone burnt could be a bone any longer, any more [illegible] they would look upon a man after he was burnt as being a man. The nitrogeneous matter in case of [illegible] disappeared with this process leaving soluble phosphate and [illegible] had 45 per cent ammonia and possessed a high value [illegible] was on the proportion nitrogen of phosphate in bone, but they would require a great more nitrogen with phosphate. Allowing 5 per cent nitrogen to [illegible] per cent phosphate in bone, they needed more than 50 per cent. bone to nitrogen. There was more nitrogen than phosphoric acid in corn, therefore bone was not suitable for corn, unless they added large quantities of ammonia.

Mr **SCOTT**, Beanston—Am I right with regard to superphosphate, that it is a great assistant to the turnip crop in its early stages?

Mr **LAWES** said it was no doubt a very important thing for this crop. Its value was immense where it could be used, and good results had been got on highly cultivated farms.

In reply to a question as to how much potash should be applied per acre,

Mr. **LAWES** said muriate of potash contained one-half of absolute potash. Three cwts. would be a large dressing for a root crop, and it was not usual to put on more. If, however, they did not export roots, they did not want potash.

Another question asked was—In what form does potash occur in farm-yard manure?

Mr. **LAWES**—Partly soluble and party insoluble.

MR. F. MUIRHEAD asked whether Mr. Lawes attributed any value to the mechanical action of dung upon the soil

MR. LAWES said in the distributing of manures it was of importance that the same amount of matter should be spread all over the land. The more they used chemical salts the more they required careful distribution. At Rothamsted they were nearly driven frantic about this, as it was difficult to get the small quantities properly distributed by machine or hand. For the last twenty or thirty years they had always been finding fault with their men in regard to irregular distribution. If they desired nitrate of soda to have full effect, every single square foot should have the same amount put on it. They must meet the difficulty by throwing in added waste, so that what the man threw badly, one way, he might throw better the other way, still they must suffer very much from bad distribution.

THE CHAIRMAN moved a vote of thanks to Mr. Lawes for the kind and explicit manner in which he had gone through every single subject, which the meeting had been pleased to lay before him. It was very seldom that they had such an agricultural treat, as they had had for the last hour and a half, and it would be of great importance if they could have occasional visits from Mr. Lawes, just to tell them what he thought during the time he had been away. He (the Chairman) had received a message from Lord Wemyss expressing regret that owing to extreme indisposition he was not able to take the chair that day.

The motion having been cordially agreed to,

Mr **LAWES**, in acknowledging the compliment, said, though he was a scientific farmer, he had some amount of practical experience having taken a farm in 1831, since which time he had [illegible] farm which he had carried on, so as to lose as little money as possible. He did not think he would make a very bad practical farmer were he to settle among them to-morrow. He did not object however, to a little science in these days of what was called artificial farming. They made a great many mistakes in these days, which might be rectified if they knew the science of farming. A number of foreign countries were paying more attention to this subject than they were now doing at home. France, Germany, the United States, and one or two other countries were now paying greater attention to this science than they had ever done, and watched very closely its progess. He should not like to see his countrymen falling back in this race now going on in the world, and he thought the tenantry, in whose hands was the produce of the land, required, to know far more of the science of agriculture than they knew at present.

This having terminated the proceedings, the meeting dispersed.

The following are the tables referred to in the course of Mr. Lawes' lecture:—

TABLE I.

Farm-yard Manure without purchased Food, Average Composition, One Ton contains—

Organic matter	5⅜	cwts.
Mineral matter	0⅝	,,
Total dry matter	6	,,
Water	14	,,
Total	20	,,

Selected Constituents.

Potash	11 lbs.
Phosphoric acid, reckoned as phosphate lime... ...	8 ,,
Nitrogen	12 ,,
Total	31 lbs.

TABLE II.

Comparison between 1 ton farm-yard manure and 1 ton produce:—

	Potash.	Phosphoric acid as phosphate lime.	Nitrogen.
1 ton farm-yard manure	11 lbs.	8 lbs.	12 lbs.
1 ton cereal grain	11 ,,	35 ,,	40 to 45 ,,
Grain more or less than manure	0 ,,	+27 ,,	+28 or +33
1 ton farm-yard manure ...	11 ,,	8 ,,	12
1 ton potatoes ..	12 ,,	8 ,,	8
More or less than manure ...	+1 ,,	0 ,,	—4

TABLE III.

Comparison between 8 tons potatoes and farm-yard manure containing the san [illegible]

	Potash.	Phosphoric acid as phosphate lime.	Nitrogen.
8¾ tons [illegible] manure ..	96 lbs.	70 lbs.	105 lbs.
[illegible] tons [illegible] ...	96 ,,	64 ,,	64 ,,
[illegible]	0 lbs.	6 lbs.	41 lbs.

THE PLOUGHING IN OF FARMYARD MANURE.

A DISCUSSION on this subject has lately taken place at a meeting of the East Lothian Agricultural Club and the principal points raised were where it was better to plough in dung immediately after its application on the stubbles in autumn, or allow it to lie spread on the surface throughout the winter.

Of course the question is far from a new one. Nevertheless, there is nothing like substantial unanimity of opinion in practical circles on this point, any more than on many other strictly agricultural questions. The *North British Agriculturist* writes on this subject:—It has occurred to us that the nature of the climate has no unimportant bearing on the solution of this subject. Where our early practical experience of agriculture was derived—on the cold heights of Upper Banffshire—manure is generally applied with the green crop seeds in April, May, and June, but when dung is applied in autumn as a rule, farmers endeavoured to get it ploughed in as early as possible. This applies to the north generally, particularly to the colder climates and later districts. In the central parts of Scotland where the climate is more favourable not only the opinions but the practice of the farmers differ—the former more than the latter—as to the advantages of several weeks or it may be months. In the southern counties of Scotland where the dunging on the stubble in autumn is more extensively practised than in any other part of North Britain, most farmers plough in the manure as speedily as they can. This however, may not in every instance be due to the belief on the part of the farmer that it is positively disadvantageous to leave the dung exposed; it may, and we presume is attributable to the necessity for pushing forward field work in autumn, for fear of a severe winter and backward spring.

Whatever it may be with farmyard dung spread on the soil, we have repeatedly had experience of the mischief which severe frost does to manure obtained from the "folding on" of sheep. On a high lying farm in Banffshire, with which we had something to do, it was at one time the practice to fold sheep during night on lea ground of a lightish character, with a view to the improvement of the manurial condition of the soil. The folding took place generally from July till November or December. The animals were kept on one break until a liberal coating of manure was secured. The earlier folded portions sent up a short, thick, dark sole of grass. That, however, rather helped than hurt the succeeding grain crop, provided always that the top-dressed was ploughed in before severe frost came on. An effort was generally made to have the "dressed" portion of the field ploughed before winter, but oftener than once this was not quite accomplished. It need hardly be added that thoroughly wintry weather comes on earlier in that part of the country, and is much more severe than in the Lothians. In one season about one-third of the manured part was unploughed when an intense "black" frost was experienced for over a week. It was feared that this would to a large extent neutralise the effect of the sheep manure, and to test the matter a portion of the unfolded-on area got no artificial or other manure. Well, the result was, that the dunged part that was ploughed before getting the sharp frost yielded a splendid crop of oats, while on the portion that was equally well manured, but not ploughed, when the weather broke, the crop was not nearly so good—indeed, it was only "a shade" better than what grew on the section that got "nothing" but seed and labour. Two years thereafter a rather smaller proportion of the sheep-dropping-manured area was caught in a similar way by John Frost, with results substantially corroborative of the above.

The question is one of so much importance that we shall be glad to give in our columns the experience of gentlemen who feel inclined to write on the subject, and have watched, either from a practical or scientific point of view, the comparative advantages of ploughing in or leaving dung exposed for a considerable time. A Mid-Lothian farmer, [illegible] shrewd, practical man, favours us with his experience, which is not unworthy of a place in this column, and runs thus:—"For at least the last quarter of a century I have been in the habit of allowing the dung on a portion of either the pototo or turnip break, and some years both, to remain weeks and often months spread on the surface without being turned in on different varieties of soil, and have invariably found that the manure which lay spread on the stubble for weeks or months produced a better crop of either potatoes or turnips than that which was covered in immediately after being carted out on to the field. I have had good opportunities of testing this, being in possession of two farms which although lying contiguous, are of very different soils. The one is composed of deep loam with a considerable portion of moss, whereas the arable portion of the other is rather a clay soil with strong clay subsoil, while another portion is light with a gravelly bottom. I may mention however, that both farms are thoroughly drained. Unfortunately I took no account either of weight or measure, but the difference was at all times most perceptible to the eye even of persons unacquainted with agricultural affairs.

"Seven years ago a field of ten acres, intended for potatoes, was all manured on the stubble with summer-made farmyard manure, at the rate of about twenty five tons per imperial acre in the month of October; but only about two-thirds of the said field was ploughed in at once, the other part, and decidedly the worst part of the field, not being ploughed in until April. I had occasion, along with my son, about the end of June or beginning of July, to go alongside the field. On coming to the portion where the manure had been six months spread on the surface there was a marked difference in the appearance of the potatoes. They were much darker in the colour and broader in the leaf than the rest. When I asked what was the meaning of this, my son replied, 'This is the place where the manure lay all winter on the stubble without being ploughed in until we were going to plant the potatoes.' At lifting time I believe there was nearly a third more on that than any other part of the field. The wheat the following year showed a stronger growth and produced also a better crop than the other part of the field.

"A farmer some years ago said, he thought it would be better for me to allow the dung to lie on heaps as drawn from the carts, as it would not waste so much. I replied that his suggestion would be the very means of wasting it, whereas in being spread regularly over the ground the land was thereby truly benefited. Another farmer said he disapproved of my plan, as he was anxious to get it into the ground with as much sap in it as possible. It appears to me that the land chemically has the power of absorbing the constituents it requires from the manure. Some chemical process goes on which I cannot properly explain, but I know that dung lying for a length of time on the surface breeds worms, and something of a greasy nature is engendered that causes the surface of the soil to appear rich and mouldy or slimy, which I hold to be essentially requisite for vegetable life and growth. There seems to be some sort of affinity between the soil and dung, so that the amalgamation goes on better when the manure is lying loose on the top of the soil than when it is covered in. The air and soil apparently act conjointly, in preparing the manure for being assimilated as the soil requires or can absorb. The elucidation or solution of this point ought to be one of the many ways in which chemistry is destined to aid the practical farmer."

CULTIVATION OF WASTE LAND.

A SCOTCH farmer, who has successfully brought waste land into cultivation, gives the following account of his operations, from which planters and agriculturists in this country will be able, no doubt, to gather many useful hints. If the waste land is encumbered with trees, or scrubroots, or large surface stones they must be removed before it is ploughed. A sledge is better for carrying off for short distances large stones than any wheeled vehicle, as being lower, it is more easily loaded and heavy stones soon destroy carts. Any handy man can soon make a sledge, and the stones are useful for building fences. The methods of cultivating wild land are common ploughing, trench ploughing, trenching with the spade and mattock, or by paring off the surface and burning it. With us trenching by hand-labour is too expensive, though in many cases it is the most effectual, and I have adopted it in bringing what had been woodland into cultivation. The trenching is carried below the roots of the trees, and if they are thick on the ground it is as cheap a way of doing a very expensive job as any. The most approved method is for the labourer to dig a trench about three feet wide, and perhaps fourteen inches deep, throwing the earth from the first trench on the side, away from the land to be operated on. He then proceeds to mark off another three feet in breadth, takes off the turf as deep as the spade will go, lays it with the grassy side down in the bottom of the trench and puts the remainder of the earth to the depth of fourteen inches on it, using a pick or mattock to loosen the subsoil if too stiff for the spade to penetrate. He thus proceeds till he is over the field, leaving the roots and large stones on the surface till they are removed when the soil is a little consolidated. Lime should then be spread on the land, a light seed furrow ploughed at the proper season, and the crop sown. This is the most effectual method of breaking up waste land, but is too expensive unless it is wanted for some especial purpose either of use or ornament. Trench or subsoil ploughing, may be done by putting a strong force of horses or bullocks into a plough of strength sufficient to stand the strain, and ploughing a furrow at once deep enough. The more practicable plan is to use two ploughs at once, the second following in the track of the first. The second plough may be made according to the cultivator's judgment of the soil to be operated on, either with a mould board to throw the earth it turns up above the slice made by the first plough, or it may be worked without a mould board, and only loosen and stir the subsoil below without bringing it to the surface. We often find in our black topped moorlands, six, to eight inches below the surface, a kind of thin plate of concrete-looking substance, which we call "moor pan" and it is absolutely necessary to break this up if we look for any good result. If the turf only of poor waste land is turned over it should be laid flat to rot, and, after lying about a year, should be cross ploughed before a crop is sown. If the seed is sown immediately after the first furrow we rarely get its value back again in the poor crop produced. In all these cases lime and abundant manure are necessary to get good crops, as these waste lands are generally of poor quality, and either for that reason, or from being wet, have been left uncultivated when the better land has been chosen for cropping. There is an excellent way of bringing moss land into cultivation which I have often seen practised by small farmers, though I don't remember ever having seen it done on a large scale. This is by growing potatoes on it, in what we call 'lazy beds." The moss, having been drained, and dug, or ploughed, is marked off in beds about five feet wide, with intermediate spaces about two feet in breadth. Dung is spread on the surface of the beds, and the potato sets placed on it, and are covered with earth dug from the intermediate spaces. When potato shoots begin to appear above the ground they get another thin covering of earth, and are there left until the crop is ready for lifting.

AGRICULTURAL CONTRASTS IN INDIA.

THOSE who have sailed along the Eastern and Western Coasts of the Indian Peninsula are struck with the different scenery and land culture. The Eastern Coast might be represented by a sandy plain, with a palmyra to indicate the tropical climate. The Western Coast would be shown as a forest, the rich green of the cocoanut plantations appearing in the foreground, as a fringe to the coast line, and if the traveller explored the interior he would find the land to be one of orchards and rice culture—a veritable garden of the Hesperides. The hasty reasoner might enter in his diary that the inhabitants of the Western Coast were better farmers and a more civilized race, judging by apparent results, whereas his opinion on traversing the Eastern Coast districts and observing the barrenness of the soil might be the reverse.

The difference in the tropical scenery we have adverted to—the solitary palmyra as contrasted with the cocoanut forest—is solely due to a different rainfall. On the West Coast 70 to 120 inches of rain keep up the perpetual verdure; on the East Coast 30 to 40 inches—and in the interior sometimes only 20—do not foster plantations, and barely nourish a yearly crop of grain. The soil of Malabar is actually inferior to that of an East coast district. The rice grown is of an inferior quality to that nourished by a river silt. Easy is the life of those for whom the rains provide all the moisture needed for agriculture. They grow rich by the unearned increment of annual prosperity. Famines are unknown. The only desolation known is when Nature revenges herself for the neglect of sanitation, and small-pox and cholera carry off their thousands.

Far different is the life of the hardy agriculturist of the Eastern Coast and of the interior, where rainfall is scanty. Where the British farmer would dig a drain to carry off the surplus moisture, the Indian farmer digs a well to help him to increase the deficient moisture. The drain and the well are startling contrasts. Even should there be an equality of rainfall to the Briton and the Indian, yet what inequality of solar heat, and of consequent evaporation! In the British Isles, or in any island, hot winds are unknown—their effect in evaporation of surface moisture is very great. We see here such different conditions that the same practice seems hardly applicable. Let us picture Hodge, Sandy or Pat, ever handling the creaking picottah or impelling down the slope, the overtired and emaciated bullock before he could hope to reap a harvest, and the cultural contrast becomes apparent.

The drainage suitable to an over-charged clay soil or to a fenny marsh, seems quite inapplicable to sandy and gravelly soils. Wheat must be irrigated and root crops will simply not grow. The succulent swede changes its globular form for a fine head of leaves, and a root of the [illegible] remarkable for the woody nature of its fibre. Of what [illegible] is it to recommend root crops and rotations? Cholum and cotton alternate on the black rich soils which depend on rainfall; raggy, wheat and tobacco rotate on lands under wells diversified by crops of chillies and other vegetables suitable to the country. Cumboo, tennay, samai and other lighter grains occupy the lighter soils, depending on rainfall. Introduce exotics and they degenerate. We have seen what happens to a turnip; carrots fare no better—even the tomato, a semi-tropical fruit becomes a button, and peas are nowhere. The laws of Nature—rainfall, temperature and soil—must be observed. In two or three generations the sturdy Briton, unbraced by a return to his own climate, acquires the manners and customs of the native, and becomes deficient in energy of mind and body. Seeing these things are so, can we fight against Nature, and ought not all attempts at improvement of agriculture to be made in the channel in which it is now conducted, by setting an example in the use of neglected manures and of decreased expense of irrigation? We shall never effect much change in this country. Let us show better paddy, sugarcane, turmeric, native vegetables, [illegible] wheat, cholum, raggy and other dry grains—irrigation conducted at less expense—and possibly our example will have an effect in time. Agricultural prizes given at the Horticultural Show would do some good, while prizes for tea and coffee are money thrown away. The European needs no stimulus to turn out an article suited to the market.—*Madras Times.*

MODEL FARMS.

THE recent notice in these columns, of Mr. Buck's paper on the "Climate and Resources of Upper India," touched incidentally on the value of model farms as a means for the instruction of the ryot, in the solution of the grand problems which no doubt have puzzled every one who has had anything to do with agriculture, since Adam delved and Eve span. We recognised the true position of what are now called model farms, as a centre where experiments might be carefully and systematically carried on, and where as much might be learnt from failure as from the most successful results obtained by the application of processes which must for centuries remain far beyond the power and opportunities of the Indian ryot. On the other hand, we accepted Sir John Strachey's definition of the true use to which we might put the numerous estates now under the superintendence of the Court of Wards. Here should be exhibited the results of the experience gained at the model farms, in the simplest and most practical form, for the edification of the ryot himself. He should here learn for himself, by the labour of his own hands and by the evidence of his own eyes, the value of deep-ploughing, of spare irrigation, of new staples, of conservation of manure, of greater domestic comfort and personal independence. Something, it is true, has been done in this direction, but as yet little in comparison with the vast opportunities at hand. At the same time it is impossible to deny that model farms, as they now exist, do little to improve the condition of the Indian ryot, and are themselves no advance on the empirical experimentalising in agricultural matters, with which every collector, who has had a turn that way and could get hold of a plot of ground, has amused himself since the occupation of the country.

In 1814 A. D., the district of Cawnpore was governed on the most liberal principles by a remarkable man, Mr. Ravenscroft.

"This Gentleman, the handsomest and most athletic European in India," says Colonel Sleeman, in his *Journey through Oude*, "and one of the most expert in the use of the sword and shield, and who lived in that lavish hospitality and open-handed munificence which led to and ended in his ruin, had, in spite of his great faults, the interests of his district thoroughly at heart." Amongst other schemes this remarkable man set on foot, was the establishment of a model farm. On the occasion of the Governor-General passing through Cawnpore on tour, he addressed His Lordship, in a letter repleto with the classical allusions characteristic of the polite letter-writer of that period, and soliciting the genial warmth of Government favour for his project. "Passionately devoted," he writes, "to this delightful art, (of agriculture), I was lately the humble instrument of establishing the first society of this kind (for the support and improvement of the practical agriculture of India), since the time that a British foot was planted on the soil." This society was called the Futtehgurh Agricultural Society, and Sir Edward Colebrooke was the first president. History is silent as to the scope and result of its operations; and, indeed, the fact that Mr. Ravenscroft so earnestly solicited support from Government by the allotment of land for experiments, and the institution of a "national farm" of about 500 acres, would seem to imply that, for want of money, the society, established under such favourable auspices, was in a bad way. In a later paragraph, Mr. Ravenscroft speaks of his "own little farm;" and there can be no question that this officer had as warm an interest in agricultural experiments and improvements as any officer of the present day, when not only model farms but even special departments, show how highly Government recognizes the necessity of publicly encouraging agriculture, "the source of wealth in India, from whence springs, for the most part, the revenue of the State." No need in these advanced days to quote "the illustrious Tully who called agriculture one of the breasts from which the State draws its nourishment, and who, instructing by precepts and stimulating by rewards, prevailed upon his countrymen to cultivate the arts of husbandry." No longer does the peaceful encouragement of agriculture need the memories raised by the following stirring sentences. "When the Romans made the most illustrious appearance, husbandry was in the highest estimation amongst them." "In those happy days," said Pliny, "the Earth, pleased at seeing herself cultivated by victorious hands, seemed to make stronger efforts, and to produce her fruit in greater abundance.' There is now no lack of countenance; but can we say that, as yet, any more satisfactory results have been achieved than those of the Futtehgurh Agricultural Society and Mr. Ravenscroft's National Farm, the very memory of which has melted into air.

Has, for instance, the McComas' water-lifter, of which our correspondent in Australia gives such glowing accounts, been tried anywhere but on the Government farm at Cawnpore? Have the zemindars been induced to give a trial to the Beheea Sugar mill? If not—and we have no reason to suppose that they have—a grand opportunity has been lost. Want of leisure partly, and want of interest, have acted as obstacles to any systematic propagandism. But the time for a half-hearted and feeble method of instruction has passed. The learner must be got hold of, and induced by every legitimate means to learn. Not only should every Court of Wards' Estate be furnished with supplies of agricultural instruments cheap and efficient, but the more intelligent proprietors should be encouraged to come and see for themselves results worked out by instruments whose price is quite within the reach of the well-to-do Kurmi or Jat. Or a loan association could be started, which, under proper direction, would lend out pumps or sugar-mills to accredited borrowers. We have reason to believe that many would hire where few would purchase, at least till satisfied of the results obtainable. We have said enough to show that the full influence which model farms could use in the improvement of agriculture is not yet reached, and to indicate, in a small degree, the direction in which that influence would be most successfully used. We have seen that model farms, are not the newly invented "notions" they are supposed to be though the time has yet to come when they are made of practical value to him whom they are intended to benefit—the Indian ryot.—*Pioneer.*

ENGLISH FARMING AND INDIAN WHEAT.

NO longer isolated by protective duties, the agriculture of Great Britain is peculiarly susceptible to foreign influences; and among the most important factors of the future must be reckoned the import of wheat from India. It is clear that, when 300,000 quarters of wheat are known to be afloat and on their way to Great Britain from Indian ports in the course of a single month, an appreciable effect must be produced on the home market. Putting our entire annual purchase of foreign wheat at 14,000,000 quarters, the present rate of import from India is nearly one-fourth of the whole. But the trade shows signs of further development. In 1875, 98,600 tons weight arrived; in 1876, the quantity was more than doubled, and 230,000 tons reached us. The bad harvest of the present year gave a fresh impetus to the trade; and arrangements will be made to increase the facilities of transit, and so lead to further shipments. Yet this immense business sprang up from so apparently insignificant a cause as the repeal of an export duty of 3*d.* or 3½*d.* per bushel, according to the current value of the rupee. What then may result when still greater energy is shown in the trade, or if it should be practically made an imperial investment by guaranteed irrigation works? For it is upon this wheat export that the promoters of the scheme principally rely for the pecuniary return.

Now, when it is remembered that the annual value of English agricultural produce is estimated at £300,000,000, it is evident that a gigantic monetary interest may possibly become liable to serious disturbance. If Indian wheat comes here in such incalculable profusion as promised, the cultivation of that crop by the English farmer will be proportionately interfered with. On the other hand, the American growers, finding the price of corn rapidly depreciate, will partially abandon that line of investment and turn their attention more and more towards the export of meat. In a measure they have done so already, and have succeeded far enough to prove the project practicable So that on either hand the English farmer has cause to look with apprehension upon an overwhelming Indian export; it must affect him whether he produces meat or corn. Within those districts which lie north of the Tweed, where the corn harvest seems periodically destroyed by inclement weather, such competition would probably be fatal to the cultivation of a cereal which, only under very favourable circumstances can be relied on. Much further south wheat is only retained in many districts, because in the first place, it is a condition of cropping insisted upon in the lease, and, secondly, because of the high value of straw. Every single item of expenditure upon arable farm has increased of recent seasons—labour, for instance—so that the amount of capital now required to produce the same weight of stall-fed beef is perceptibly larger. This renders it exceptionally sensitive to competition, and the tendency of events is plainly shadowed forth when an authority who is specially identified with high farming is found recommending farmers to substitute sheep for cattle.

The drift of these considerations is that, if the Indian export ever reaches but one-third of the expectations formed by sanguine irrigationists, English agriculture will be revolutionized. To cultivate corn will become unprofitable, and the edge of the great grass holdings, which for some years has been silently moving eastwards across the country, will finally overlap the ploughed lands. Then the only possible agriculture will be the grazing of cattle and sheep. Now that farming enterprise at home should be directed more and more to the production of meat in preference to cereals, in itself cannot be regarded as a misfortune, because modern population becomes every year intensely centralized in cities which could not exist in our climate without enormous quantities of mutton and beef. But a vast and sweeping change of this character brought about in the course of a few years would necessarily be attended with much distress, not only to tenant-farmers, but to the proprietors of land. There can be little doubt that such an event as the arrival of corn on the scale anticipated would depreciate the value of arable agricultural land in a rapid and striking manner. For there are wide districts whose geological formation will not permit the growth of grass of sufficiently rich character to bear the continued grazing of bullocks; these, therefore, must suffer greatly in a comparatively sudden change. Though the Americans would certainly compete with meat, dead and alive, yet there the English agriculturist has much less to fear. If he could succeed in reducing the cost of producing beef and mutton but one penny per pound, he need be under no apprehensions as to importation from the United States. When transit extends over thousands of miles, a mere fractional variation in price makes an extraordinary difference, as is seen at the present moment in this very movement of Indian grain. The cheapest meat-producer is grass, which requires so little labour; consequently, as these causes came into operation, the country would gradually assume a prairie-like aspect.

In connection with this possibility another point arises—that is, the import of linseed, cotton-seed, rapeseed, and maize from India; in other words, of cattle food; for all these are now largely utilized as feeding materials, the first three in the shape of cake, and maize when slightly crushed. In 1875, 172,006 quarters of linseed are returned as received from India, a quantity which in 1876 increased to 727,312 quarters. These imports also are to rapidly develop according to the irrigationers; if so, they must exercise an influence on English agriculture second only to the wheat, and tending in the same direction. Should artificial cattle food fall in price, as would then happen of course the consumption would proportionately rise. A farmer finding this would say —"What is the use of my spending large sums of money on manure, labour, steam machinery, and so forth, when I can purchase food for my cattle cheaper than I can grow it? This immense import of oil seeds quite does away with the necessity of my ploughing and sowing, the more specially as the opinion of some authorities is now turning against the use of turnips. I don't want to grow wheat, because Indian grain has rendered it a dead loss, I don't want to grow roots, now artificial food is so cheap; all I want is some hay and green stuff, and why then should I go to my present excessive expenditure on arable land?" Clearly it will soon be pecuniarily impossible. Wheat itself has already been used in England as cattle food during the depression in price which happened a few years ago after an abundant harvest; if it came in such quantities perhaps it would again be employed. The main object under such circumstances must obviously be to produce as large hay, clover and green crops generally as possible, to the exclusion of cereals and the partial superannuation of the plough, such green materials to be supplemented with imported artificial food. Here also the irrigation of India points to the production of meat as the great future purpose of English agriculture, and the very possiblity of this irrigation partially coming to pass by private enterprise, if not by governmental interference, should be an inducement to the farmers to make preparations for the consequences.

Briefly summed up, vast imports of Indian wheat and oil seed mean another rise in the value of pasture land, a depreciation of arable land, the laying aside of the plough, less demand for agricultural labour, and a general alteration throughout the system. —*Pall Mall Gazette.*

THE NEILGHERRIE BOTANICAL GARDENS.

Report for 1876-77.

THE Madras Government reviews this Report as follows, —From the report it appears that the Government Gardens on the Neilgherries had much to contend with, owing to the unfavorable season (1876-77), and that from the same cause there was a lessened demand for plants and seeds. The receipts were, therefore, smaller than usual, while increased expenditure was necessary for the maintenance of the Gardens. This additional outlay seems to have been irregularly met from the amount specially granted for the new green-house, which could not be utilised in full while blasting was going on in the vicinity of the site. The accounts being in the old forms, it is impossible to trace accurately the expenditure under each grant, and the Government reserve their opinion on the transaction pending submission of the promised special report on the subject. They notice that the Acting Commissioner is fully alive to the existence of irregularities of practice, and trust that the introduction of the new forms of accounts during the present year will secure regularity in future.

2. The results obtained with the new varieties of potatoes are encouraging, but the stock appears to be still too small to admit of their being generally offered to the public. The Commissioner proposes to arrange for an increased supply being raised on some Badaga holdings, but if the land referred to by the Superintendent, or other suitable Government land is available, it would be better that it should be used for the purpose, as the crop would then be grown under Mr. Jamieson's immediate superintendence and on clean land. No Australian varieties have apparently been tried, an endeavour should be made to obtain some, as already ordered.

3. The publication and distribution of the Superintendent's Notes on the cultivation of the potato should be expedited. Its preparation was ordered in 1875, and much valuable time has already been lost. The Government direct that an ample supply of the superior seed-potatoes and of the Prickly Comfrey forage plant be held available for use by the Principal of the Lawrence Asylum on the Asylum farm, and that he be informed accordingly.

4. The success that has attended the cultivation of the Ipecacuanha, Rhubarb, Jalap, and other medicinal plants is very satisfactory, and the Government desire that attention be kept direct to this important subject.

5. Credit is due to the Superintendent for the improvements in Sim's Park, which appear to have been designed with taste and effected with economy, and the work done on the Stonehouse Park may also be considered satisfactory. The Government desire that the grounds at Norwood receive constant attention from the Superintendent who should endeavour to maintain in them an ample supply of flowers and flowering shrubs and ornamental trees and a good fruit and vegetable garden.

6. The Government are glad to learn that the fresh experiment that is being made with Liberian coffee at Burliar is likely to succeed. They await with interest a further report as to the fruiting of the West African plants. Further information should be obtained regarding the trees of this species that were distributed to private parties.

7. In the planting operations in the Ootacamund Garden the systematic arrangement directed in paragraph 6, G., O., 3rd July, 1875, No 1,002, should be kept in mind.

8. With future annual reports the Government desire to receive a statement of the dates and duration of the Superintendent's visits during the year to Sim's Park at Coonoor, and to the Burliar and Kulhutty Gardens respectively.

OPIUM.

A NUMBER of the opium cultivators who were taken from India to Mozambique by the promoters of the Mozambique Opium Company, returned to Bombay last month. They describe the land taken up by the company at Mozambique, as well adapted for opium cultivation, and say that very large out turns may be expected.

THE selling price of excise opium in the different districts of Bengal, has been fixed by Government at the rates specified below. Each district officer is requested to report direct to the Board the date from which the new rate came into effect in his district, if any change is made in the price previously in force in that district —

DIVISIONS	Districts.	Selling price per seer. Rs.
Burdwan	All districts, except Midnapore	26
	Midnapore	27
Presidency	All districts including Calcutta	26
Rajshahye and Cooch Behar	All districts	26
Dacca	All districts	26
Chittagong	Chittagong and Noakholly	26
Patna	All districts	16
Bhagulpore	Monghyr	16
	Bhaugulpore and Sonthal Pergunnahs	20
	Purneah	26
	Maldah	26
Orissa	All districts	20
Chota Nagpore	All districts	25

THE *Shanghai Courier* concludes a leading article upon the opium question, with the following able and soundly reasoned paragraphs:—

"It cannot fail to be noticed by any one who pays attention to the statistics of the China trade, that the consumption of Indian opium decreases in proportion to the distance from the Coast; thus at Chinkiang, deliveries amount to 10,000 or 12,000 chests, per annum; at Kiukiang to about 2,100 chests, and at Hankow, a port of exactly three times the trade and importance of the other two, to 2,300 chests. This circumstance would indicate that imported opium finds a rival with which it is less able to compete as its cost is enhanced by increase of the distance it has to travel. The opium of Shensi is described by Baron von Richthofen as a powerful rival to the Indian drug; its annual production was estimated seven years ago at 50,000 *piculs.* Szechuen produced as much. Honan is a large producing province; in Shantung and Manchuria the cultivation rapidly increases, and it has recently been introduced in the south, near Amoy. The production of Chinese opium cannot be estimated at less than 200,000 *piculs* per annum, and might be fairly computed at more. The total import from India does not exceed 95,000 *piculs*, the native production therefore more than doubles the foreign import.

"These are facts which appear to be either steadily ignored or blinked at by the anti-opium agitators, who urging upon the Government, by means of what Reuter calls an "influential deputation," the ratification of the Cheefoo convention. The clause about opium proposed in the convention, is to the effect that the Chinese shall be at liberty to impose any tax they please upon its delivery. It is perfectly clear from the reluctance of the English Government to sanction this suicidal clause, that

Sir Thomas Wade was not acting under instructions; nor is there any probability of its being confirmed by a diplomatist. Quite apart from the opportunity it would give the Chinese of favouring the native article at the expense of the foreign, by protectionist duties, and the embarrassing uncertainty which would be introduced into Indian finance, a very powerful engine would be placed in the hands of Chinese diplomatists, which they would not fail to avail themselves of in any future negotiations. They could raise the duty to a point that would entirely stop consumption of the foreign article, while it encouraged the growth by raising the profits of the native, and thereby plunge Indian finance and trade generally into the most intolerable disorder.

The anti-opium agitators are simply calling upon their Government to make a great sacrifice at the expense of the great dependency of England, that which was once called "the brightest jewel in the crown," but which is now to "perish," according to the policy of Sentiment, rather than that the "grisly phantom" of British interests should be preferred to the redress of the fancied wrongs of Bulgarian Christians, or the supposed welfare of Chinese opium smokers. But when the Indian Government has been forced to wring fresh taxes out of our poverty-stricken fellow subjects in India, in order to meet the chasm in their revenue, will the anti-opium agitators be any nearer their object? That is what they might make some attempt to prove not simply to people at home who know nothing about the trade, but to those who are well acquainted with the facts. A rise of fifty per cent in the market owing to a deficiency of about 30 per cent in the crops of some provinces in China, is a stubborn fact, that should very considerably modify their attitude.

GARDEN.

WE would draw the attention of our readers to a prospectus published elsewhere, for the annual supply of imported vegetable and flower seeds by subscription. The terms of subscription which are on a graduating scale, are moderate, and the privileges *seem* liberal.

MR A. P. WEBB writes to the *Civil and Military Gazette*:—A high authority in the N.-W. Provinces very recently pronounced it useless to sow flower seeds before the end of September, as the results are not superior and the trouble greater. My experience has been different during the 2½ years I have taken to flowers.

I sow everything that will germinate, *from April to the middle of October*, and the following are the results at so early a period of the season as January:

Stocks 15 inches in diameter and 8 inches in height *commencing to bud*.

Wall flowers, 10 inches in diameter, 10 inches in height.

Phloxes 7 inches to 11 inches in diameter and 8 inches to 10 inches in height *in full flower* since 7th September. Flowers enclosed.

Pansies of various sizes *beginning to flower*. One flower enclosed.

Helichrysums, from 2 feet to 1½ *feet* in height, *also in full flowering*, these showed flowers in fact at the end of September. Two flowers enclosed.

Xeranthemums little bushes *covered with flowers*. Two enclosed, injured by the late rains.

Ammobiums little bushes *covered with flowers*. One enclosed.

Helipterums, Catananche, Whitlavia, Chrysanthemum, Aquilegia, Leschenaultia, Helenium, Godetia, Nolana, Calendula, Eschscholtzia, Asters, Oenothera, Viola, Verbena, Clarkia, Saponaria, Leptosiphon, Silene, Allysum, Mignonette, Leptosiphon, Lavatera, Sweet pea, Malope, Geranium, Carnation, Dianthus, Delphinium, Bartonia, Linum, Virginian Stock, Mesembry, Anthemum of sorts, and Candytuft, are in fine growth.

Of Asters I have had abundance. One lot sown in April and another in July have just done flowering, another lot sown in first week of September are showing buds.

All the above flowers are hardy and do not mind frost a bit. My garden is an open one but I am putting up shade for tender annuals. It may be that my plants generally constitute more frost than plants elsewhere, because the most of them have been *twice* transplanted and all of them not less than once (Excuse Hibernicism). The result is that the plants are properly wooded, or sufficiently so ere the winter completely sets in.

The plants are put down from 1 foot to 2 feet apart. Thus very few plants of any given variety will suffice to cover the area required. There can be no question that this system is the right one, if bushy floriferous plants are required and flowers of size and substance sought.

Pot cultivation I have found a great nuisance and the result not worth the trouble, whatever may be done by professionals with the aid of stimulants in raising plants within confined spaces for flower shows. Plants raised in pots by the uninitiated in trade tricks are wretched things in comparison with those reared in beds. In the latter there is abundance of root space, and these roots are not subject to injurious fluctuation of temperature as the roots of plants in pots. Any one who has turned a plant of full growth (such as it is) out of a pot will find a perfect net work of roots, sticking all right round the inside of the pot. Burnt clay is liable to great variations of temperature during the 24 hours (winter and summer), the periods within which extremes of temperature must affect pot plants most injuriously. Plants in pots are not only less healthy, less vigorous, and less floriferous than bedded plants, but their duration is shorter.

My stocks defy hot winds and sun right up to the rains, when they rot. Of course their great floral display is quite over by the first week of April; but the plants remain green and attempts at flowering are persistent up to the rains. Be it noted that my stocks begin to flower in the first week of January, and are in greatest beauty *during all February and first week of March*. This is the result of sowing in July and two transplantings.

My Petunias attain a diameter of 5 feet with literally hundreds of blooms on each plant. Sown in July and twice transplanted, they are now 2 feet to 2½ feet in diameter, and in full flower, and will by February attain a diameter of five feet. My Pinks, sown in July and twice transplanted, show 50 to 60 blooms on each plant now, making me credit for the first time the illustrations of Dianthus in the flower lists published by some seed merchants and nurserymen. And so on with other plants showing the superiority of bed cultivation.

But still another matter to complete the information sought to be conveyed. No labour should be spared in weeding and loosening the soil all over the bed, and *carefully so about the stems of the plants*, so that the fertilising effect of the atmosphere may permeate the soil and cause abundance of roots. Not until the plant shows foliage that covers and shelters the stems thoroughly, should loosening the soil be discontinued. Look to this for success rather than abundant fertilising material, which latter only creates unwieldy plants, with little stamina to resist drought or heat. In other words manure moderately and *till* constantly to the period when the plant's growth is fairly established.

FORESTRY.

WE hear from Travancore that Blue gum Trees, at an altitude of 2,700 feet, have grown 18 feet in 8 months.

ON the Continent of Europe, where the forests have long been under State control, we find them yielding considerable public revenues. The forests in Prussia give a net profit to the Government of about £1,000,000 a year. The Bavarian forests alone yield a revenue of about £600,000, there being an acre of forest per head of population in this portion of the German Empire; this should be an encouragement to our Government which, we think, may look confidently upon our Forest Revenues, as an important and yearly increasing addition to the imperial coffers.

According to a memorandum, written a few months ago by the Inspector General of Forests, on the cost of timber operations in the various Forest Divisions of the North-West Provinces, it is the opinion of Dr. Brandis that the present state of the forest of those provinces is not such as to justify extensive timber operations, "except either to meet some urgent public demand and the regular timber requirements of the open country outside the hills, as far as they cannot be satisfied from other sources, or the production of a considerable surplus revenue, which shall furnish the means for the protection and improvement of the forest." So far at least as the Deodar forests were concerned, this condition has, it would seem, been brought about mainly by the necessity of meeting the requirements of another department of the State for sleepers for the Rajpootana Railways.

AGRICULTURAL STOCK.

AT the request of the Government of India, the Home Government have lately sent out six South-down rams for the Hissar Cattle Farm.

GREAT success has attended the sheep farming at Lovedale, Ootacamund. The out turn of meat was on an average 56 lbs. per sheep, and the mutton is described as the best seen in this country, if not any where.

WE learn from Rangoon, that very few ponies have come in this season from the Shan Hills, that the prices asked are unreasonably high, and that the few animals that have come, are very poor specimens of the justly celebrated Pegu pony. Owing to the marked deterioration in the so-called Pegu pony, Mr. Eden introduced some small Arab stallions to keep up the strain of Arab blood, which the Pegu at one time is supposed to have possessed. A couple of Arabs were, we believe, sent to Mandalay a few years back, but the results have not been made public. It would be worth while to send some Arabs to the chiefs in the Shan Hills.

HORSE BREEDING IN GERMANY.

(FROM A CORRESPONDENT.)

As the supply of horses both for army and private purposes is of such serious importance in India, I beg to send you the following account of the measures adopted by the Prussian Government for improving the breed of horses in Germany. Being on leave of absence from India, I went to Germany last autumn, and visited several of the private and Government studs. The largest of the latter is at Trachenen in Eastern Prussia, and a few miles from it are two branch studs at Catenau and Brachupen. The buildings are of brick or stone, and are surrounded by several thousand acres of land, partly pasturage and partly used for growing hay, clover and oats. Each establishment has attached to it a superintendent and veterinary surgeon. There seemed to be very few stable men in proportion to the number of horses. The system adopted by Government is the, in the end, very economical one, of buying the best possible stallions, at almost any price, crossing them with first-class mares, and rearing the best of the colts so produced as stallions to be distributed over the country districts for use with the mares of private breeders. It resembles in some respects the zemindary stud system in India, excepting that only stallions of excellent quality are used. I was informed that nearly the whole of those in Northern Germany are now supplied by Government there being very few belonging to private individuals.

At Trachenen there are fifteen stallions and three hundred brood mares Some of the former are English thoroughbreds, bought at prices ranging as high as £5,000, or more. Among them are horses with the blood of Emilius, Voltigeur, Stockwell, and others equally good. The mares are generally German or half-bred English. They, as well as the stallions, have evidently been selected with special reference to breeding for army purposes, having almost invariably the points needed for giving endurance when subject to the starvation and other hardships of a campaign, such as short backs and legs, deep barrels well ribbed up, good loins and quarters. with plenty of breeding. They have also, as a rule, good shoulders and hocks. A few stand rather over at the knees and are too small underneath in bone and sinew ; but the latter defect is of less importance than it other wise might be, in consequence of the animals being well bred. The best of the foals are kept at Trachenen, the colts to be reared for stallions and the fillies for brood mares. Those that are not thought sufficiently good for such purposes are sent to the branch studs at Catenau and Brachupen, and kept for remounts. In summer they have nothing to eat but clover and grass. In winter they each receive daily 6lbs. of oats, 8lbs. of hay, and 10lbs of straw. Although this is a cheap way of feeding them, I cannot help thinking that they would be benefitted by a little oats during the summer and more hay in winter. They are, however, though not fat, in good condition, which perhaps is owing in some degree to their being generally compact in shape. They are never groomed until sent to their regiments at three and a half years old. The colts reared as stallions have each 6lbs. of oats daily from the time they are weaned until two years of age, and afterwards 10lbs. The brood mares have 3lbs. of oats daily. Both before and after foaling, they run in the fields all day, and come to the stables at night. The foals after being weaned are kept loose in sheds and yards until one year old, and then turned into the fields all day. In the studs at Catenau and Brachupen I was shewn several hundreds of the young remounts from two to three years old. There were scarcely any with the defects which are so difficult to eradicate from our Indian breeds, such as toes turned out, sickle hocks, &c. I saw only five or six that were weedy or of really bad shape. The young animals are evidently treated with great kindness, being as gentle and fearless, as those formerly reared in our Bengal studs.

The Government has establishments at Graditz and Stuttgard, which are said to be managed on exactly the same principles as the three above described, but being pressed for time I did not visit them.

It seems that the chief rules observed by Prussia may be thus briefly summed up :—

1. Never to keep in the studs either stallions or mares of inferior quality.
2. To send stallions of only a superior class into the country districts for the use of the breeders,
3. To charge for their use such a moderate price that a stallion belonging to a private individual, if of an inferior kind, has little chance of being employed.

I may here remark that although there are in England numbers of stallions equal to, or perhaps better than any others in the world, those distributed throughout the country and generally used by English farmers, are on the average decidedly not so well adapted for getting useful and hardy stock, as the young animals now being reared at Trachenen. If the system adopted by the German Government be persevered in for some years, it cannot fail to succeed. The time required will, of course, depend upon various circumstances, such as the knowledge of breeding possessed by German farmers and the size and quality of their mares. I was informed that the latter are generally large in the North and small in the South of Germany. I went to a fair at Insterberg, near the frontiers of Russia, and noticed that the majority, perhaps two-thirds, of the horses driven by the farmers were of good size and sufficiently well bred, the remainder being small and often low in condition. The Government buys remounts from the breeders, when they are a little over three years old, for about 200 *thalers* (£30) each. They are not worked until four-and-a-half years old. There are many farmers, possessing only two or three mares and no horses, who, like the majority of our Indian [illegible], are too poor to kee colts until they are three years old, and [illegible] to sell them wh *yearlings to their richer neighbours. A large breeder at Georgenbe whose stud I looked over, buys many of these animals every year. Pa from giving them plenty of food, and partly no doubt from selecti the best-shaped ones, he often sells them as remounts for 300 thal.* instead of the usual price. *The same gentleman rears a large number o* stallions of very superior quality, some of which *are bought by the* Government at high prices. I saw in his stables about sixty *two-years-olds*, almost all of which were admirably adapted for breeding army horses. At Detmold in Hanover is a stud, belonging to the Prince of that place, containing a race of horses called the "Senner," formerly very celebrated for hardiness. It sprang originally from a cross between Arabs and German mares, but of late years only English or half of English thoroughbred stallions have been used. Germans seem generally to dislike the Arab because his stock is apt to be undersized, though they admit its powers of endurance. The mares and stallions shewn me at Detmold were of good shape and blood, in many cases very excellent, but I think generally inferior in power and substance to those at Trachenen and Georgenberg. The mares and foals are allowed to run upon a large tract of forest and meadow land some miles from the city. There are sheds into which they can go for shelter when they wish. Until four years of age the young animals are never tied up. From the first winter after they are foaled, they receive each 3 *kilogrammes* (about 6⅝lbs) of oats daily. The breed seems to me to be well adapted for light and medium cavalry. —*Pioneer*

MINERALOGY.

NEWS come from Ootacamund that fifty tons of quartz from Wright's level in the Alpha gold mines have produced over forty-one ounces of gold. Still better results are expected this month. Specimens, it is added, are being bought by visitors for cabinets.

THE statement that 50 tons of quartz from the Alpha gold mine have produced over 41 ounces of gold, is calculated to revive curiosity in the mineral resources of the Wynaad. A gentleman writing to the *Madras Mail* from that district remarks :—" It seems to me from the experience I have gained that all that is required to develop the mineral resources of this district is capital and experienced and scientific knowledge." It is estimated, we believe, that 6 dwts. of gold per ton of quartz will yield a fair return for working the reefs, so that the recent yield shows very satisfactory results. What this correspondent says about " experienced and scientific knowledge " being required in extracting the gold from the quartz is perfectly true, as will be found by reference to Australia. The Ravenswood mines in Queensland have produced as much as 6 ounces of gold per ton of quartz. Many reefs in that Colony are known to contain as much as 12 to 14 ounces a ton. But a great deal of gold is lost in the process of crushing and washing. Mr. Daintree, a colonial geologist, declares that gold " equal in amount to the total revenue of the Colony, passed into the tailings of the Ravenswood mills during 1872, or about three times as much as that saved by the proprietors of the reefs." There can be very little doubt with good machinery, scientifically worked, the Wynaad reefs will give a much better yield of gold than has yet been obtained. The question of producing the precious metals in India, instead of importing them, is one of such vast importance to the prosperity of the country, that it is to be hoped the Duke of Buckingham, who is taking much personal interest in the Alpha experiment, will consider the advisability of obtaining the services of an officer from Australia, practically acquainted with the latest appliances in quartz mining and crushing, with the view of determining whether the reefs in the Wynaad could not be worked on a large scale with fair chances of success. The experience obtained by the present miners, who are working with but imperfect resources, would certainly justify a thorough mineralogical survey of the district where gold is being discovered.

THE Duke of Buckingham last month inspected an interesting collection of specimens of auriferous Wynaad quartz, and forty-one small bars of virgin Wynaad gold which have been on view at Messrs. P. Orr and Sons, Madras. The gold mining capabilities of the Wynaad cannot yet be estimated, as insufficient capital has been spent in their investigation ; but it is a significant fact that in addition to attempts that are being made under Madras auspices to solve the problem, Messrs. W. Nicol and Co., of Bombay, with characteristic enterprise, are prospecting in the district.

We learn that His Highness the Nizam's Government has been informed of the existence of petroleum springs, somewhere in Kummum district.

An officer of the Geological Survey is to be deputed to visit and report upon the coal fields and petroleum localities in the Aracan division.

In a village, named Khagoorda, situated in Nowanuggur, a white marble mine has been discovered from which five marble slabs six feet square have been dug. They have been sent to the Jam Saheb of Nowanuggur, who has ordered them to be sent down to Bombay to be polished and made into ornaments.

Two skilled engineers, from the oil-regions of Pennsylvania, have arrived at Foochow, under contract with the Chinese Government for the purpose of opening up the oil wells in the neighbourhood of Kulung. All the necessary appliances for working the wells are on the way from America.

The Siam Government is devoting much attention to the working of the gold mines of that country. At a place called Bang-tapalin, gold of the first quality is available, and is used for the manufacture of gold vases and water goblets, and some who are lucky enough to secure gold during some of the most important ceremonies performed by the King, preserve it for the sake of curiosity. The Government of Siam has a mint of its own and all the gold recovered from the mines, it is suggested, may be sent there to be converted into coin.

Some time ago, the Indian Government forwarded to England for experiment 100 tons each of coal and iron ore from the Warora beds in the Central Provinces. A portion was handed over to Mr. Ireland of Manchester, who forthwith instituted a series of trials with different processes. We are told that these experiments have succeeded in placing beyond question the capacity of India to supply at least a portion of her requirements for steel goods. By means of what is called "the Blair process," Mr. Ireland has succeeded in producing from the Warora minerals a pure spongy wrought iron of the first quality. Not content even with this remarkable success, he has manufactured some of this iron into a steel that experts consider equal to the best produced in England. The satisfactory results of the experiment have already been communicated to the India Office, together with a recommendation that the necessary plant should be forthwith sent out to India for working up the raw material on the spot.

SERICULTURE.

SILK-WORM'S EGG CARDS.

(*Fram the "Nichi Nicki Shimbun," 2nd November.*)

We recently called attention to the sad failures among the merchants of silk-worm's egg cards at Yokohama. The raisers of cards and the dealers in them are actually ruining themselves. The cause of these failures is that the merchants, intent only on making money without trouble, take no warning by past losses, but go on in the same senseless manner, losing year after year and giving no consideration to what they are about. When they bring their goods to the market, they find that it is only to lose again and again, because they pay attention only to the branches of their business and none to improve the condition of the trunk or root.

The other day the merchants of Yokohama held a meeting there, and discussed the question of the advisability of destroying their cards by soaking them in water, for the same reasons that induced them some years ago to burn them. Without making any effort to arrive at the actual causes of the dullness of the market the proposition was assented to. But scarcely had they put their seals to the agreement, when their ideas underwent a change and it was then determined that each man should be permitted to dispose of his cards as he pleased. That every merchant should be entitled to the right of selling as he pleases, is of course the proper mode of transacting business. To what good therefore do such consultations tend?

The Government will be compelled to take some decided steps in this matter. There are two alternatives. One is to limit the number of cards that may be brought to market; the other is to let the merchants follow their inclinations in the matter and thus ruin the trade by their action. The officials must chose one course or the other. No advantage, either direct or indirect, can be obtained by secret interference. Some time ago the Government attempted to interfere, and made certain regulations with regard to silk-worm's egg cards, but their action was so severely criticised by foreigners, that the measure was abandoned and nothing has since been done in the matters. In 1874, however, a large number of cards were burned in Yokohama, and though we have no certain proof that such was the case, we believe that the Government bought those cards from the merchants and had them destroyed. Since 1875 the dealers have formed an association among themselves, and the Government showed itself disposed to help them and limit the number of their cards. In 1876, three wealthy merchants of Tokio and Yokohama assisted this association by lending money to its members and enabling them to keep up prices. We hear that the Government also secretly furnishes them with funds. There is no doubt that though the Government at this time did not appear to be openly concerned in the matter, it was secretly lending its assistance.

Both producers and merchants quickly discover that the Government will assist them. Relying therefore on this aid, and taking no warning from the experience of former years, they, this season again, conduct their business in a way that must naturally lead to ruin. To the weak kind of assistance lent by the Government this state of affairs has to be attributed.

If the Government thinks, that the trade in silk-worm's egg cards is one that is of no value to the country, why does it not openly interfere and prohibit their export? The merchants and producers would then take more pains about the quality of their silk, which would result in great profit to the country. Though foreigners might oppose the measure, Japan should defend her sovereign rights as an independent nation. It is not likely that the Italians would in consequence send out men-of-war to bombard Yokohama, but if the Government really believes that such action might lead to obstruction of trade, it would be well if it would take charge of the whole crop of eggs, receiving the cards as payment of taxes, and exporting them to Italy or France. Surely foreigners could not raise any objections to such a proceeding.

If the prohibition of their export, the limitation of their production, or the Government assuming entire control of their sale, are not considered good suggestions, on the ground, that the Government should not interfere in matters of trade, then we would urge that no assistance, direct or indirect, should be given by the Government. The cards will then become a production like tea or silk, and when the dealers in them lose year after year, they will appreciate the necessity of conducting their business with greater care. At all events, the Government should refrain from giving secret aid, for this only affords the merchants encouragement for increased peculation, and consequent increased loss.

The Planters' Gazette.

TEA.

We republish elsewhere, a very highly colored article by the *Ceylon Observer* on the prospects of Tea cultivation in that island. Indian Planters may rest assured that Ceylon will never, become a rival in the export trade of this staple to Great Britain. Tea cultivation in Ceylon will, no doubt, continue to slightly extend but only so far as to meet the local consumption. Financially speaking, tea cultivation in Ceylon cannot compete with India, the flushes not being sufficiently numerous.

We witnessed at Messrs. King Lockhead's premises, Calcutta, on the 26th ultimo, the working of Baker's Rain-wet Tea Leaf Dryer. The peculiarity of the machinery consists in the facility with which it dispels, during the rainy season by mechanical means the adhering moisture from tea leaves, which afterwards are to be dried over charcoal. The desirability of such a machine has been for a long time felt in Assam and Cachar, and now that its powers has been tested, there is every probability of its being generally adopted. The machine was filled with thoroughly wetted leaf and two powerful fans, driving air through it were set in motion. Twenty minutes sufficed to remove all the water with which the leaves had been moistened. The machine pretends to do nothing further than to render the leaf *rain dry*, and we were satisfied that it did all that.

OUT of a total of eight hundred gardens in the province of Assam, 87 new ones were opened during the past year.

AN increased demand for Indian tea in the Home market has resulted in higher prices at the last Calcutta sales.

WE see it stated that, within a radius of nine miles in one district, the Upper Assam, the acreage under tea has increased in the last ten years from about 500 to nearly 5,500.

THE Nassau and Holta Tea Companies, we hear, have respectively turned out 140,000 lbs. and 100,000 lbs. during the last season.

MESSRS Lloyd and Cheshire's Indian Tea Report gives the total quantity of Indian tea imported into London from the 1st January to the 30th November last, at 28,360,000lbs., as compared with 25,884,000lbs. imported during the corresponding period of 1876.

THE Darjeeling paper says that as soon as Government has marked off what land it requires at Dumsong for cinchona cultivation, &c., a considerable acreage will be allotted to applicants on cultivation leases.

ON the 31st December, the stock of Indian tea in London for the three years 1875-76-77, was 9,500,000—11,800,000 and 15,400,000 lbs., respectively, and the deliveries for the same period, 2,000,000—2,000,000 and 2,500,000lbs., respectively.

MESSRS. BALMER, LAWRIE & CO. inform us that the deliveries of Indian tea in London during December, amounted to 2,500,000lbs. as compared with 2,000,000lbs., for the same month last year, the stocks on the 31st ultimo were 15,400,000lbs. against 11,800,000lbs.

WHILE good teas fetched fair prices at the sale of the 17th ultimo, it was noticed that a break of about 300 chests of Nepaul tea was put up and fetched from fifteen and a-half annas for flowery pekoe, to one anna for dust, we suppose. A Native garden in Assam run these prices pretty close, we read, obtaining one anna and nine pies for some of its tea. The highest price fetched at the sale was Rs. 1-7-6 for Assam tea.

AT the tea sale held on the 28th January, prices were very firm. All desirable teas sold at a slight advance, others remaining at former prices. The highest price of the sale was realised by the Pashok Tea Estate, Darjeeling, its broken Pekoe fetching Re. 1-10-6 per lb. This garden also obtained a very high average (0-15-1 per lb. for 102 chests), the Burkhola Tea Company Ld., Cachar, alone exceeding it by 1 pie per lb., but for only 79 chests. Many of the Darjeeling gardens seem to be maintaining the high character which they obtained in former years and in the earlier part of the season. Recent London circulars place Darjeeling in the highest place as regards teas received up to the end of last year.

A CONTEMPORARY informs us, that the political officer in charge of the Naga Hills lately reported the existence of large tea-trees there, which the Nagas are accustomed to cut down for firewood to save themselves the trouble of climbing to gather the seed. One tract of country, about 12 miles long and 6 broad, on the slope of the Burrail mountains, seems meant by nature for tea gardens; but it lies in the land of independent Nagas, and for the present, can only be coveted. The Chief Commissioner remarks that "the manner in which these very valuable plants—the tea-trees—are destroyed, is but a sample of how the national wealth of the province has been, and is still, wasted."

INDIAN tea, we hear, was successfully introduced to the public, at the last Cattle Show, in the Agricultural Hall London. The Indian Tea Agency, of 2 Jermyn Street, opened a room within the building which afforded visitors an opportunity of judging the merits of Indian teas. A remarkably good-looking Hindoo, in full Oriental costume, was in attendance. A full service of every kind of Indian tea was supplied to all comers. The first of the guests were the Duke and Duchess of Manchester, and the last Lord Chesham, Vice-President of the Smithfield Club. Intermediately a party of upwards of 200 was entertained, including most of the judges, members of the committees of the Club, the Lady Mayoress and her daughters. The satisfaction expressed with the quality of the tea was perfectly unanimous. The Agency had also a stall in the bazaar, gorgeously fitted up with Oriental draperies and decorations, where the teas were sold. The British public is not easily moved in favour of any new article of consumption, but in the matter of tea every man judges for himself, and we are sure that not long hence, instead of drinking tea which even at present owes its chief strength and flavour to the Indian product mixed with China leaf, they will take more generally to the use of the pure unadulterated article from India, with advantage to their palate and purse.

THE principle feature of the labour question in Sylhet is, says the Dacca paper, that it is the only district in the Province in which Managers can, to a certain extent, rely upon a supply of local labour. Large numbers, not only of the natives of Sylhet, but also, of the Khasi and Jaintia Hills, are employed upon the Sylhet tea gardens, though the supply is not nearly equal to the full extent of the demand, and must consequently be largely supplemented by emigration. During the year 1874-75, there was an increase of 357 in the number of Act VII labourers, and of labourers otherwise imported, an increase of 1,042 souls. Mr. Hare the Assistant-Inspector, reported that the industry was making rapid strides. In 1874-75, seven new gardens were opened in the district. Of course, Sylhet has many advantages as a tea-producing district. Added to the fact of a fair supply of local labour, which can always be counted upon for opening out, or extending, cultivation—a work for which imported labourers are mostly unfit—there is a good extent of waste land to the south of the district, the soil of which is eminently adapted for tea cultivation. Of late years too, it is said, that the climate is less injurious to European constitutions. As the country opens out, it will become healthier. The spare land fit for tea is being so speedily taken up, there will be none left soon.

TEA cultivation in Java has been extending during the last few years. In 1868, 1,017,593 *kilogrammes* of tea were exported from Java. The exports increased slowly to, in 1872, 2,075,583 *kilogrammes*, and in 1876 they were 2,382,007 *kilogrammes*. In 1877 the exports have been doubled, 4,114,673 *kilogrammes* having been exported up to the end of September.

TEA is now one of the staple products of Japan, the last yearly production amounting to 25,000,000lbs., and is chiefly exported to the United States. It was first cultivated in the beginning of the thirteenth century, when the priest Migoye brought over seeds from China, first into the province of Chikngen, in Kinshin and afterwards into Togano-o and Uji, south of Kyoto. The latter province produces the best kind of tea. The tea plant growing in the province of Suruga is a native of that part of the country. It is an interesting fact that owing to the climate on the west coast, the tea plant in Japan grows much farther north than is generally admitted, *viz*; to the 39th degree, in the province of Yechigo and the neighbourhood of Niigata. According to the observations of one of the residents of that city, who attributes the mildness of the climate to the peculiar currents existing in the Japanese sea, the average temparature of the coldest months, January and February, is but little above the freezing point. The thermometer goes down, however, sometimes as low as 16° Fahrenheit, and the preservation of the plant, in spite of this cold temparature, must be attributed to the fact that the winter sets in with heavy falls of snow, and that the layer of snow protects the plant against the effects of the cold. This occurs when the plant is flourishing, and when fructification has already begun. In spring the snow rapidly melts, the buds of the preceding year open up, and the seeds ripen until the following autumn, when they fall off and are carefully gathered up. Tea seeds are frequently used in Japan for making a very fine oil. Ever since the earliest period of its cultivation, the tea has been very highly esteemed in

Japan, on account of its beneficial effects and soon became one of the necessaries of life, as well as the indispensable accessory of friendly gatherings.

TEA CULTURE IN THE NEILGHERRIES.

TEA was first introduced into the Neilgherries by Colonel Crewe in 1830, but little attention was paid to the plants, and it was not until Captain Mann introduced a number of plants which he had obtained from China in 1845, that tea was attempted as a regular plantation. The Captain's experiment was continued by Mr. Rae in 1859, since which time tea-gardens have sprung up in every direction. There are three classes of plants on the Neilgherries, the original China variety as imported by Captain Mann; the original Assam variety, indigenous to the north of India; and the hybrid plant, a cross between the two. The China plant is by far the most hardy, and will thrive under very trying circumstances, but the growth is slow, and the leaves are small. The original Assam plant is comparatively more delicate, and will not grow on exposed situations or in poor soil, but where the surroundings are favorable, the growth of the plant is incomparably more rapid, the size of the leaves larger, and the crop gathered greater, than of the China plant. But the class of plant most affected, is the hybrid variety. This has been found the best suited to the Neilgherries, for it has the hardiness of the China species, and the large leaves, and quicker growth of the Assam. Tea can be planted with profit, on any spare ground, in the garden of the householder, or round the native hut. There is now a ready market for the green leaf, at any of the factories belonging to the larger plantations. The plant itself requires but little care or attention. The chief responsibility of the planter, is in the manufacture and preparation of the leaf; which requires constant attention, and much scientific experience and knowledge. The tea-house, while the making is going on, demands the personal supervision, and presence of the master. The proper amount of rolling, fermentation, firing must be decided by an expert, as on these depend the quality of the tea, and its price in the market. Were the planter free of this responsibility, there is little special difficulty in the actual culture.

Although tea will grow so easily, the produce mainly depends on the climate. A warm damp atmosphere, with frequent rain throughout the year, induces frequent flushes. The flush is the growth of little sprigs, from these are gathered the two first freshly formed leaves, and the unformed top leaf, known as Pekoe tip; it is only from those barely developed leaves, that good tea is made, for as the leaf hardens the theine principle is lost. Tea made of the coarse large leaves, has none of the refreshing effect of tea made from proper leaves. The flushes, or growth of these little sprigs, is caused by the upward flow of the sap, and every shower of rain, or other favoring incident, will give the tree a start, and make it throw out these shoots. As a rule the unhealthy climates at low elevations are the best for large crops and good returns. As many as thirty flushes in the year are produced on some of the low-lying Assam estates, gathering going on continuously from the middle of January to the middle of December, leaving only one month for pruning and putting the trees in order for another year's picking. But although the returns are much larger in such localities, (as much as seven hundred pounds of made tea being produced on some of the Assam estates, to the acre of cultivation), yet tea will thrive and give sufficiently paying returns, in the most healthy situations on the Neilgherries. Many properties there have given as much as two hundred and fifty pounds of made tea to the acre. Well protected hollows, with well selected plants, proper cultivation and manure, are to be found, producing large crops of tea in the most charming climate. While however selection of site is of great importance, yet tea can be made to pay where there are few natural advantages. From the small expenditure necessary in terracing the grass hills, and in hoeing up, and keeping free of weeds, the small space of cultivated land between the banks of turf, the cost of establishing a tea plantation can be reduced to a minimum. With terraces cut three feet wide, and plants put in these two feet apart, there are a great many plants in an acre of ground, and a small yield from each plant will well remunerate for the outlay, the principal item of which is the cost of the plants themselves. With a lovely climate and easy work, many a planter can be satisfied with comparatively small returns for the money he invests, and judging from the demand for land of this kind which has lately sprung up, it is probable that a large extent of tea may be shortly planted in this manner. But to the outside capitalist the advantage of good climate, and easy work, is not of importance. To such the largest possible return for their money is the principal object, and the Wynaad opens a promising field for the industry. Tea is now being grown there most successfully, the growth exceeding any thing that has been known on the Neilgherries. The land that has been planted with tea to such advantage, is such as is considered not suitable for coffee, and thus an opportunity is offered of turning to account many thousands of acres on which the latter plant will not thrive. And when tea factories have been established, where the green leaf can be disposed of by the small proprietors, fields of tea will doubtless be cultivated in conjunction with coffee, on most of the estates in Wynaad.

HOW LONDON TEA SALES ARE MANAGED.

(*J. C. Sillar & Co.*)

THE tea trade has long been a bye-word for mismanagement and iniquitous "trade customs," and in few branches of commerce has the system of trading upon borrowed money taken such deep root; the losses to importers, as a natural consequence, have become proverbial. The present season has proved no exception to the rule. A more disastrous and disgraceful state of business has rarely been witnessed in any market in the world than that ushered in on the morning of the arrival of the steamer *Loudon Castle*, from Hankow. She made the quickest passage from China on record, having completed the voyage from Woosung in thirty-eight days. She entered the Thames at 6 o'clock on a Tuesday morning, her hatches were opened at 8 A. M, and by 10 A. M. her teas were in course of delivery, sales having been made at 1*s*. 8*d*. per lb. During the day, sales of about 6,000 packages were reported from 1*s* 4½*d* per lb. up to 2*s* 5*d*. per lb. So far, so well. The following day about 4,000 packages were put up for sale "without reserve" upon the old terms, the false balance, and the time bargain system, and the "slaughtering process," as it is termed in the trade, commenced. The *Gleneagles* arrived the same afternoon, and next morning, a panic prevailed in the market: teas for which 1*s* 4½*d* had been refused the previous day were sold at 1*s*. 1½*d*. and within fifteen minutes were knocked down in the sale rooms at 1*s*. 1¾*d*. Ever since that the market has been demoralised, and it has been impossible to give quotations, counterparts of the same chops being sold at the same time at a difference of 2*d*. per lb. One large parcel, for which the selling brokers had refused 1*s* 6*d*. per lb., and costing upwards of 1*s*. 7*d*, laid down, was thrown away at the "auctions" at 1*s*. 3*d*. per lb., the laughable part of the farce being that whereas teas to be sold, say this morning at the so called "auctions", must be ready for delivery within seven days, or the buyer has the power of cancelling the contract should he feel so disposed, he, on the other hand, need not take delivery before a couple of months hence, and may claim all exactions and down weight, and also heavy usury upon all the purchase money he may pay before that date.

A TEA CONFERENCE.

WHAT was termed by the promoters a "Tea Conference" was help lately in Southwork-street, London. The following "resolutions" were adopted:—"1.—That, in the opinion of this meeting, the amount of adulterated and unsound tea in this country is such as to cause serious apprehension, not only on the part of the public, but in the mind of the retailer, who may be brought under the penalties of the "Food and Drugs' Act" for being the holder of such tea. It is therefore imperative that the present state of the trade should be brought under the notice of the sanitary authorities and the Board of Trade, to procure the destruction of all such tea now in bond, and to induce the Custom House authorities to prevent such tea being taken in bond for the future. 2.—That from competition, and the reason stated in the former resolution, the position of the tea trade is in an unsatisfactory state, and that some steps should be taken to place it on a sounder basis, both as regards the retail profits and the standard of excellence. 3.—That a critical examination be made of the merits of compression and other methods of treating tea, instituted with a view of eliciting definitely the amount, if any, to which the value of tea is enhanced by compression, &c. 4.—That a mixed committee of tea experts, scientific gentlemen, and representatives of the general public, be elected to carry out the foregoing object, and report thereon."

The following remarks are from a paper distributed at the "Conference" on "tea-keeping and tea-making":—

The refreshing and exhilarating effects of tea depend principally on the warmth of the infusion, and the presence of a crystalline alkaloid, known as theine, which contains more nitrogen than most other substances, and yet never undergoes putrefaction, and a peculiar volatile essential oil. The warmth of the infusion comforts the stomach, and, by inducing a gentle perspiration, gives a sense of lightness and increased strength to the whole frame; the great effect, however, is produced by the theine and essential oil. According to Dr. Lankester, tea contains in 100 parts—Water 5 0 theine 3·0, caseine or cheese 15 8, aromatic oil 9·75, gum 18·0, fat 4·0, sugar 3·0, tannic acid 26·25, fibre 20·0 mineral matter 5 0; or summarised as follows; Water 5·0, flesh-formers 18·0, heat-givers 72 0, mineral matter 5·0.

The amount of theine in good ordinary tea amounts to from 1 to 3 per cent., while the volatile oil barely reaches 1 per cent. The theine being tasteless has nothing to do with the flavour of the tea, which is entirely due to the aromatic oil and the tannin contained in the leaf. In inferior teas, the aromatic oil is almost entirely wanting; it is, however, made up for by the large amount of tannin present, which gives to the beverage an amount of astringency that is highly relished by those who are unaccustomed to the more delicately-flavoured kinds, where the tannin is in the minority, just as the habitual fiery port and sherry drinker prefers those highly-flavoured spirituous wines to the more delicate crus of the Burgundy and Bordeaux districts. These three principles—the theine, the essential oil, and the tannin—being the only ones concerned in making tea one of the most refreshing and invigorating beverages that we possess, a very slight consideration of their properties will soon show us the best and easiest way of getting a good cup of tea. This is a point that is greatly neglected by housewives. The essential oil which gives tea its characteristic flavour and aroma is extremely volatile and soon passes off, especially, in a warm dry room or store closet. Hence the absurdity of leaving tea in paper, an open chest, or a loosely-fitted caddy. We need only examine a true Chinese or Japanese tea caddy to see what pains the far Easterns take to keep their tea fresh. The covers of these caddies are as nearly air-tight as possible, and are frequently in two or even more outer boxes to prevent the volatile oil from escaping. As theine and tannin are not volatile at ordinary temperatures, very little pains need be taken to keep them intact as long as the tea is kept tolerably dry. We next come to making the tea. If we soak tea in cold water we get a light brown liquor containing gum and colouring matter, but not theine, essential oil, or tannin, which constitute the "goodness" of the tea as housewives term it. To extract these, we must use water taken the moment it boils, the object being to get as much of the theine and essential oil as possible, together with a certain amount of tannin. Many people fail in making good tea, in spite of plenty of excellent material and boiling water by using a cold tea-pot. Hot water poured into a cold vessel falls several degrees below the temperature necessary to extract the virtues of the tea. To make good tea, the pot must always be previously made hot, either by boiling water or by being placed near the fire. The modern "cosy" is a capital invention for keeping the pot hot while the tea is drawing. Having given the boiling water sufficient time to draw out the theine and essential oil—generally about ten minutes—we should stop the operation by pouring out the tea. The tea-pot should be sufficiently large to hold all that a family may require; the practice of re-watering or filling up the pot a second time should always be avoided. If we allow the hot water to continue acting on the leaves too long, we shall extract too much of the tannin, which, by its bitterness and stringency, will entirely destroy the delicate flavour of the essential oil. In addition to this the volatile essential itself will be driven off by the long-continued heat. It is for these two reasons that boiled tea is always distasteful to the real lover of the fragrant cup. It is this practice that makes continental tea so unpalatable, as the new tea is put on the top of that which has been exhausted, until the pot becomes full of spent tea-leaves. This plan reminds us of the Dutchmen, who, according to Nickerbocker, when they put on a clean shirt, never troubled to take off the old one, and similarly, with their nether garments. Tea-making is really a delicate chemical operation, but the essential conditions of success are few and easily performed. In chalky districts a large pinch of carbonate of soda is often put into the tea-pot to soften the water. This is a bad plan, as an overdose is generally given. The best way is to put a piece of common washing soda into the kettle. A piece, the size of small pea, is amply sufficient for a two-quart kettle.

OBSTACLES TO PLANTING ENTERPRISE IN ASSAM.

NOW that the tea industry has become of such immense importance to India, not only in a commercial, but also in a political and social point of view, it behoves us to call attention to certain matters which tend seriously to affect its prosperity. One of the greatest obstacles in the way of the tea planter is the ever-increasing tendency to over-legislation, the effect of which is rather to harm than to benefit the people of India in retarding their employment in remunerative work, and delaying the opening out of immense provinces, not only by Europeans, but by the natives themselves.

When adult coolies, landed on a garden in Assam, cost over one hundred rupees per head (and this cost, fearful though it is, promises every day to be increased) and the planter has to take all risk of unfitness, desertion, sickness or death of the coolie, and even then has him engaged for no more than three years, any further engagement involving a heavy bonus and possibly increased pay, the planter has to think twice as to the number of coolies he will employ. Another great disadvantage under which gardens, worked solely or principally by imported labour, are placed is, that a uniform establishment has to be maintained throughout the year; whereas twice as much labour is required during the greater part of the manufacturing season as is needed in the cold weather. If the Government and the planters were to work hand in hand in the matter, and mutually determine to improve and develop the country, this nuisance might be reduced to a very great extent by the importation, under vastly improved conditions, of a sufficiency of labour for the manufacturing season and by the employment, during the cold weather, of the surplus in making roads, bridges and other public works, the Government paying to the planter a fair proportion of the cost of importation of the coolie. This plan would prevent the unseemly competition that now goes on between Government and the planter in recruiting labour, the one with all the wealth of India at its back the other obliged to spend money with the utmost prudence in order to secure a fair return for his capital. Many of the planters would, no doubt, be willing to contract for the construction of roads, &c., in their own neighbourhood. Another plan which appears to us perfectly feasible, is that Government should encourage ryots from the over-crowded portions of Bengal, &c., to settle in Assam, Cachar, &c., and, by giving them employment, enable them to add to their income.

The vast strides in the increase of the revenue of Assam, since tea-planting became its leading industry, ought to show the Government of India that, in putting tea-planting on a satisfactory footing, it would benefit itself as well as the planter. The bitter complaint of capitalists is that, for the vast amount of money which they are compelled to spend in recruiting labour the coolie himself derives no tangible benefit, and that the money filters through all kinds of intermediate agents,—heads of villages, recruiters, contractors, and whom the present unjust, burdensome, unnecessary regulations compel employers of labour to make use of. This will show that it is nothing inherent in tea planting itself that reduces the profits to a minimum; and when we say that it costs over ten thousand rupees merely to land a hundred adult coolies on the garden in most parts of Assam, we have stated a case which demands speedy and radical reformation.

The action of Government in reserving what may be called scrub-land to the Forest Department, and the enormous charges for timber required for plantation purposes, is also most injurious. Let Government, while reserving to itself really valuable available timber land, recognise the fact that planters are working amidst fever, solitude, discouragement, and that, especially at the present time, the prices realised do not represent any very large margin, and that the plums in their pudding are none too many, without Government taking away the few that there are and thus perhaps "killing the goose that lays the golden egg." There are also many absurd restrictions to the obtaining of waste land for planting purposes. The handicapping of European capital and enterprise by Government is a most suicidal policy and at variance with the true interests of the Indian Empire. Both the Imperial and the Local Government have borne ample testimony to the kindness and consideration with which planters treat their coolies, and to the immense importance of the tea-industry in developing the resources of the country; yet with all this, they impose vexatious, unnecessary and prohibitive legislation. We would recommend that Act VII B. C. 1873, be consigned to the British museum as a relic of a bygone age, and that Government should earnestly and honestly determine to do all that in it lies to amend the errors of the past and to insure a satisfactory future.—*Englishman.*

INDIAN TEA.

(From the Glasgow News.)

IT is upwards of two centuries ago since old Samuel Pepys tasted his first cup of tea. What a change since then does the present consumption of the beverage show in the numbers and habits of the people! Although known to the Dutch in 1610, tea does not seem to have been used in this country until many years later, and previous to old Samuel's 'first cup' it is said to have been sold at from £6 to £10 per lb. We smile now at the good simple soul who threw out the liquid and served up the boiled leaves, to be eaten; but we are apt to forget the struggle there must have been between acquired tastes on the one hand, and the desire to avoid looking the gift-horse in the mouth on the other; and now tea with us is not a luxury only for the very rich, it is a daily necessity for the very poor. No article of domestic use, perhaps, is in such universal request. It serves equally as the rallying-point of the fashionable kettledrum, as the comfort of the day-labourer, and as the only solace of thousands of poverty-stricken old people. The garrulous old civil servant would marvel greatly were he to see the quantities now consumed of the strange plant from China, and still more would he be astonished at the prices at which it is sold. There is probably not a grocer in the land who does not hold out promise of the 'finest quality" at two shillings per pound. We have always a suspicion, however, of 'cheap' tea, and we cannot shake off the association of that with another adjective. It is only too well known that teas are shamefully adulterated both in this country and in China, and we forget that high authorities have declared their belief that a great proportion of the very large stocks of China teas in London warehouses is 'rubbish, unfit for human use.' There can be little doubt that the Chinese do not now pay the same attention as formerly to the preparation of teas for the English market. So long as they can produce quantity they are indifferent to quality, and, as a natural consequence, the latter is steadily deteriorating. It is comforting, therefore, to the lovers of the cheering cup to learn that we are not so dependent on the Flowery Land for our supply as heretofore. Japan is rapidly coming to the front in this, as in all other industries within her capacity, and in ten years has brought up her production of tea from nothing to 25,000,000lbs. per annum, with every prospect of still greater increase. Other lands have also taken to the production of tea, but it is that of British India which is of most importance and interest to this country.

There are few things, indeed, in modern commerce more interesting than the growth of the cultivation of tea in British India. It was a Scotchman who first discovered the tea plant in Assam, and now some of the most extensive gardens in that province are owned by Scotchmen. The vicissitudes of the pioneers of the trade were many and great. It was some years after Bruce's discovery before an action was taken, and it was still longer before that action brought forth fruit. The Assam Tea Company, which first went into the cultivation of tea in India as a commercial speculation, very nearly failed in the enterprise, notwithstanding all the concessions and assistance it obtained from Government. But after a few years of troubles its perseverance was rewarded—to what extent may be seen from the fact that it paid 35 per cent. of dividend to its shareholders last year. Of late years tea planting in Assam has been one of the few 'good things' in commerce, and Anglo-Indian capitalists have been turning their attention from indigo-planting, which used to be synonymous with gold-coining, but which now seems 'played out,' to tea-growing, and with what result the following figures will show:—In 1860 the quantity produced was 1,400,000lbs.; in 1870 it was 13,200,000lbs.; in 1876, 29,500,000lbs.; and in 1877 the crop is estimated at 36,400,000lbs. In Assam there are now about 100,000 acres under tea cultivation, and the average yield of the province is estimated at from 200lbs. to 300lbs. of tea per acre. There are, besides, some 700,000 acres of reserve lands in the hands of proprietors, and it is calculated that in the whole Bengal Presidency there are now some 1,000,000 acres of previously valueless land either actually under tea cultivation or set aside for that purpose; and it is said that some movement is now being made to introduce the cultivation into some of the lower provinces also. It will thus be seen what marvellous advances have followed upon the perseverance and enterprise of our Anglo-Indians persisting in the face of all obstacles and prejudices, and what room for still greater development yet remains. And this industry possesses an element of interest beyond that of the capitalist and higher than that of the mere consumer. It tends to the solution of one of the greatest of Indian problems—the employment of the surplus population of that vast continent. The population of India is increasing at a tremendous ratio, so that the opening up of this industry becomes a question of vast importance. To the native populace, to the social economist, to the capitalist and to the consumer, the development of tea-planting in India thus possesses features of uncommon interest.

There are few more promising openings at the present time to young men of energy, of capital, and of patience. The latter quality is essential to success in tea-planting more than in most things, for it is said that a tea-garden can rarely be productive under five or six years, and a planter should be prepared not to draw money from it during that probationary term. By not acting on this principle, many impatient and over-sanguine planters have come to grief, and a few years ago there was much tribulation in Calcutta in consequence; but to men of the right stamp there is a field—or say a garden—of rare promise open in Northern India. It is possible, of course, that it may be overwrought, and no doubt it will become so in time, as it is the fashion of the present day to overdo everything. But in the meantime there is plenty of room. It is true that the consumption of tea is not increasing in the same ratio as the production, but the British consumer will soon learn, and is already learning, to prefer good Indian tea to bad China tea. The prejudice against Indian tea is being rapidly overcome. Those who have accustomed themselves to its peculiar flavour know how very much better it is than China tea, and it will no doubt gradually attain a preference over the latter. If the Indian planters only persist in their policy—the converse of that of the Chinese—to produce quality rather than quantity, the 'Heathen Chinee' will probably find himself thrown farther and farther into the background. It may be unpleasant for him, but it will be good for British interests in India, and for British pockets at home.

TEA CULTIVATION IN CEYLON.

TENANT mentions that the cultivation of tea in Ceylon was attempted by the Dutch, but without success. The tea plant was first introduced in the British era, about the year 1841 or 1842, but it is doubtful whether the trees brought by Mr. Maurice Worms, from China and planted on Rothschild estate, Pusellawa, or a selection of Assam plants introduced by Mr. Llewellyn, of Calcutta, to Penylan estate, Dolosbagie were the earlier arrivals here. Some plants were transferred from Rothschild to Kotmale, the Ramboda pass, and Pundaloya, but no systematic attempt was made at cultivation, though for a short time the Messrs. Worms manufactured a little tea in Pussellawa as an experiment, employing a Chinaman for the purpose. The plants throve exceedingly well, and when the Ceylon Company, Limited, took over the properties of Messrs. Worms, they found a considerable extent of tea on Kondegalla on the Ramboda pass, to which they at once began to pay attention. A planter of experience in Assam became their tea manager, and an importation of Bengalee coolies was afterwards made on their account, and the Company has now about 315 acres under tea between Kondegally and the Hope, the produce of which is sold extensively for local consumption. Nearly as early in the field and equally successful are the proprietors of Loole Condura plantation, Hewahetta, Messrs. A. G. Milne & Co., whose tea under Mr. Taylor's careful management has acquired a high reputation. The pioneers on a considerable scale include, besides, Messrs. Elphinstone, Armstrong, Bayley and Rossiter, and tea plantations of fifty acres and upwards are found in districts as far apart and as varied in altitude, soil and climate as Nuwara Elliya, and Yacdessa, Maturatta and Dolosbagie, Ambegamuwa, Legalla and Sabaragamuwa, and there are now altogether no less than 2,720 acres of land planted with or felled for tea in the country.[*] There can be no doubt of a very fair measure of financial success. That has been already proved. And it is satisfactory to know that the planters in low-lying districts are equally sanguine of success with those higher up. Assam planters visiting Ceylon and forgetting our nearness to the equator and the equable high temperature experienced outside the mountain zone, night and day all the year round, have recommended tea-planting on the hill sides of a few hundred feet above the sea in the Western and Southern Provinces, within sight of the Galle road. Very probably the tea bush would grow there for a certain time, for it seems to thrive anywhere, but the question of a profitable return of marketable leaf is doubtful. Certain it is, that Assam planters who have visited Dimbula, Maturatta and Hewahetta have expressed their pleasurable surprise at the fine appearence of Ceylon tea from 4,500 to 6,000 feet above sea-level. The usual expectation has been that the higher the elevation of a tea plantation in Ceylon, the finer the flavour of the produce; while in the medium and low districts more numerous flushes would compensate for a less degree of flavour. But we are told that competent judges have pronounced tea manufactured from Yakdessa and Dolosbage growth to be equal in flavour to any of the other island brands, while, on the other hand, so luxuriant is the growth of the tea plant on Rookwood, Mr. Armstrong's Upper Hewaheta plantation, that trees only fifteen months old are fit for topping, some of them growing, to the height of 6 feet in that time. In judging of the quality and appearance of Ceylon tea, it must be remembered that, save in one or two instances, there have been no conveniences in the shape of machinery at the command of the Ceylon planters, and that the manufacture takes place in the most primitive manner. It was under such circumstances that a parcel of tea from Rookwood plantation was prepared, which has drawn forth the following most satisfactory report from a well known firm of London Tea Brokers :—

GRACECHURCH STREET.

DEAR SIRS,—We have examined with much interest the samples from Ceylon. The Flowery Pekoe is a tea of quite a fancy character with a large irregular leaf and a pale, rather fine liquor; value most uncertain: at times 1*s.* 4*d.*; at others perhaps up to 2*s.* 5*d.* per lb. Such if shipped to England, should be packed in small boxes and should be sorted, that is to say the large coarse leaves should be picked out, which would much improve the general appearance. The Souchong is a tea for general commerce, value about 1*s.* 8*d.* per lb. The leaf is good and sufficient, well made for all purposes, and the character of the liquor full, with fair strength.

Such tea would hold its own with Indian growths, and we think would be appreciated by the home trade.

We are, dear Sir, yours faithfully,
WM. J. & H. THOMPSON.

Nothing can surely be more satisfactory than this report on an assortment of tea which was a fair sample of plantation growth, prepared under the direction of a gentleman who, we believe, has had no technical experience to guide him beyond what his observation and reading have enabled him to pick up in Ceylon. Sceptics in the success of Ceylon tea have always said it may do for the local market, and if sold at R. 1·50 per pound, may pay the expense of cultivation, but how about the London market and competition with China and Indian growths? Here then is the answer in a satisfactory and most unmistakable terms. The time has now come when local manufacturers of plantation machinery—such as the enterprising proprietors of Bogambra and Fairfield Mills, Kandy, and the Fairfield Iron Works Company, Colombo—should turn their attention to the supply of the rolling, drying and sorting machinery needful for the tea planter. We are glad to think that steps are about to be taken for this very purpose.

As already mentioned, there is scarcely a planting district in the island in which tea is not now found either in a small garden patch a few acres here and there, or clearings of from 50 to 100 and even 200 acres. During 1873 and 1874, a good many plants of both the Assam hybrid and the China variety were distributed from the Peradeniya and Hakgalla gardens, but latterly the chief means of supply has been through the importation of large quantities of Assam seed from Calcutta, a very considerable business having sprung up in this way. The progress of the enterprise may be recorded as follows[†]:—

Area of tea planted out:—

	1872.	1873.	1874.	1875.	1876.	1877.
Acres	10	25	350	1,080	1.750	2,720

As respects the future, there is every prospect of the rapid extension of cultivation. Tea is deemed suitable for altitudes above and below that adapted to coffee: it is likely to yield a remunerative return in districts—in Lagalla and Maturatta—where the wind often inflicts serious injury at the critical period of coffee blossoming. Leaving out the stormy season, it is considered that there are eight or nine months during which a succession of good flushes can be obtained, while a rest—a wintering—during the remaining quarter will do no harm to the plant. Many years ago (in 1864) an experienced Horticulturist, a planter in Haputale, at the time pressed on our notice the advantages offered by several finely sheltered valleys behind Baker's Farm and on the road to Horton's Plains for the tea cultivator, and another planter of equal experience has been a consistent believer for nearly twenty years in the fitness of the western slopes of Adam's Peak for tea rather than coffee, because of the heavy rainfall. As we write, mention is made of the probable formation of a Saffragam Tea Company, and it is quite likely that before many years elapse a chain of tea plantations interspersed perhaps with cacao and Liberian coffee may run from the neighbourhood of Ratnapura to Kogala. Similar progress may be anticipated in the Central Provinces if the Government place the needful Crown reserves in the market. In this way great portions of the Pedro and False Pedro ranges between Nuwara Eliya, Pussellawa and Maturatta can be utilized, while New Galway and the neighbourhood of Horton Plains will afford large additional scope for planting tea as well as cinchona, with the great advantage of proximity to the Dimbula-Uva Railway Extension. As it is, Nuwara Eliya has become the centre of a most important tea and cinchona enterprise. Writing two years ago we said:—

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[*] In the Morowa Korale, we learn, tea cultivation is to be tried on an extensive scale on abandoned coffee land as well as in forest land.

[†] In 1867, the Director of the Botanic Gardens reported that a sample of Ceylon tea prepared from China (Bohea) plants had been favourably reported in London and for several years he continued pressing the advantage of cultivating this hardy plant on the attention of the Government and the public. Mr. Thwaites thought the natives might grow the Bohea kind with advantage, as it succeeds almost anywhere. In 1868 there were 270 plants of Assam two feet high prospering well at Hakgalla, and two years after the distribution of seed commenced, the opinion being that the Assam kind would succeed best at an altitude above the limit of coffee. In 1872 Mr. Thwaites saw no reason why the sides of our higher mountain-ranges should not be covered with flourishing tea plantations, while he strongly recommended the cultivation of the China Bohea kind on abandoned coffee land. In 1875, the fact was fully recognised that the cultivation of tea in Ceylon was an established commercial success.

> The opinion of some Ceylon planters who have visited the Tea Districts in India, and especially the Neilgherries, is in favour of cultivation at our very highest altitudes, and they regard the False Pedro Pidurutalagala, Totapela and Kirigalpota ranges as all destined to be covered with cinchona and tea plantations for a length of forty or fifty miles, with a breadth varying from three to six or eight miles. But, on the whole, the medium and lower divisions of Yakdessa, Laggala and Kalupahana are the favourities for tea experiments, and nurseries as well as large clearings are being rapidly formed in each of these districts. We cannot help thinking, too, that the Western slopes of Adam's Peak with their rich forest-clad valleys and abundance of rain, as well as the whole face of the country, wherever good soil can be got, between the Peak and Kegala are destined to be plentifully dotted over with tea plantations. The suitability of the climate and soil to produce good crops of leaf has already been proved. The difficulties about preparation and manufacture will be speedily overcome—more especially if the system is adopted of establishing central factories in districts to which the leaf could be carried from surrounding gardens, and either having it prepared on the proprietor's account, or disposed of to the factory-owner at a price which will no doubt be amply remunerative.
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> Railway extension through the fine uplands between Dimbula and Uva must give a great stimulus to both tea and cinchona cultivation, while there will also probably ensue successful experiments, under European auspices, in farming and the rearing of stock, particularly sheep. There is a great future before this island and its chief industries, now that the Government, after a hard and prolonged struggle, appear to realize the encouragement offered to a liberal and bold policy of railway and road extension.—*Ceylon Observer.*

COFFEE.

PATNA (grazing) land in Uva, Ceylon, is in request for planting coffee upon: an application for 400 acres has been sent in to Government by a coffee planter. Uva is the finest district in the Island.

Varying but on the whole favourable reports come from the coffee districts of Ceylon. During the last month, however, there has been too much rain. It is thought probable that the current season's coffee crop may range between 550,000 cwts. and 600,000 cwts. At date, the exports are 7,000 cwts below those at the same time last year.

Prices for coffee are likely to keep up yet awhile, if indeed they do not go higher. Consumption is still strong, while the supply is short. The crop sent into the market this year by Ceylon will be miserably poor, that from Southern India has not been large. In addition we learn from Java that the coffee, tobacco, and *kapas* plantations have suffered greatly from the continuous drought and heat. Latest official reports from Bali state, that the coffee crop was unsatisfactory.

We note that the whole of the coffee estates of the late Mr. Donald Stewart, the well known Coorg planter, are for sale. The late Mr. Stewart's abilities as a planter are so well known, the properties are so numerous, and have been so liberally worked, that we have no doubt the sale of the estates will excite considerable interest among capitalists. The estates are forty-five in number, comprise over 15,000 acres, and represent a value, exceeding a quarter of a million sterling. There is no doubt that it would be beneficial to the country if the estates should be sold individually, but at the same time there are few in Coorg who would not be sorry to see "Stewart's estates" broken up. They have never been looked at by the forty superintendents in any other light, than as a "whole," and it was the great ambition of young men about to commence coffee, to enter what among themselves was termed "the service," as they well knew that once secured, their appointments were permanent, their salaries liberal, and promotion rapid. Some idea may be formed of the magnitude of the concern, when we mention that the annual expenditure is fifty per cent. in excess of the revenue of the province, that employment is given to over twelve thousand coolies, and that the salaries paid to the superintendents amount to some £10,000 per annum.

Enquiries have been made in California, regarding the extent and situation of coffee plantations, said by the American *Grocer* to flourish in that State, and pay a handsome profit. The leading Journal of California says.—"We regret to say that there is no productive coffee plantation in the State and consequently there is none that pays a profit. A 40 acre field has been set out with coffee in Los Angeles country, but persons from Costa Rica and the Hawaiian Islands, think it would have been more prudent to begin with half an acre, so as to ascertain, at a slight expense, whether the plant would thrive in our climate. It is said coffee is not cultivated profitably anywhere out of the Torrid Zone. The most noted coffee plantations are in Southern Arabia, Brazil, Java, Costa Rica, the West Indian Islands, and Ceylon, all within the tropics, and in districts which, so far as we are informed, are absolutely free from frost. The tree is not cultivated extensively in Italy, Greece, Spain, Palestine, Algeria, Mesapotamia, Northern Egypt, Morocco, South Africa, the high land of Central Mexico, or Central Persia, and these subtropical regions are in various respects similar to Southern California in climate. The Southernmost part of our State is nine degrees from the tropic, and nowhere, unless within a few hundred yards of the ocean, is there entire immunity from frost, though there are many places where frosts are rare and never severe; and it is not uncommon to see annual plants, including the tomato and tobacco as well as hardier ones, like cabbage, live on from year to year, and assume something of the nature of perennials. The coffee is considered too delicate for the climate of the date-palm, and it is even doubtful whether the latter will ever bear well in our State, though it will grow freely. The planting of coffee in Los Angeles country indicates enterprise, but several years must elapse before we can say that it is a succees."

Coffee prospects in Java are bad, the season being unpropitious. According to the latest official advices from Palembang, rain fell there only once during October. A long-continued drought prevailing there, had made the state of the water in the rivers so low, that the water-courses in several districts could not be made use of for the carriage of produce. The people were awaiting rain in order to proceed with the planting of paddy and secondary crops. The coffee, tobacco and *kapas* plantations had suffered greatly from the continuous drought and heat. Latest official reports from Bali state that the weather continued dry, not a single rain shower having fallen. From want of water, only a few fields could be planted with secondary crops. The import of rice was greater than usual. The coffee crop was unsatisfactory.

Genoa as a coffee port, is thus noticed in the *Grocer*:—

From Genoa, with regard to coffee, we learn that the trade was encouraged by the facilities granted last year to the Porto Franco, and the knowledge, that the old system of bonded stores would be reverted to instead of the Magazzini Generali, which had been the special bugbear of dealers in colonials; and under the influence also of the general return of confidence in business, direct importations of coffee from the producing countries have considerably increased. This market received during 1876 not less than twelve cargoes from Porto Rico, or about 2,000 tons, against only four cargoes in 1875; and at the same time the imports from Rio and Santos, chiefly by steamers, also increased. In consequence, this market has not had to depend upon other European markets for supplies, and it is to be expected that the position of Genoa as a market for coffee and other colonial produce, will still further improve. The import of East Indian coffee continues to be restricted to small parcels; those qualities not being as yet sufficiently appreciated in Italy.

COFFEE PROSPECTS IN JAVA.

On Wednesday last, says the *London Correspondent, Ceylon Times* Dec. 6. I came across a London coffee broker who had just returned from a visit to Holland; he had been present at the November Dutch sale, and gave me some important information about the causes of the sudden spurt then, and of the future prospects of the Java crop. You know that they generally get three distinct blossoms, one in October, another in December, and a third in January, but the last is not generally of much account. News had come to Amsterdam by wire from Batavia, that in consequence of severe drought, the October blossom had failed, almost throughout the island, and that the crop would certainly therefore be very short. My friend did not leave Amsterdam until the 3rd December, and telegrams received there the previous day, reported the drought still prevailing, and gravest fears were entertained as to the fate of the December blossom, and that even if rain should fall in the meanwhile, only an extremely limited yield is the best that can be looked for, from flowering so late as January. Nor is this all the evil in store for the Dutch planters, I am assured that a season of great drought is usually followed by one of excessive rainfall, which as you know to your cost in Ceylon is quite as bad for coffee as the other. Your readers too will be sorry for the poor Hollanders, if it should turn out that they get bad crops for the next two seasons, but still I dare say that Ceylon planters will get over it, if they have luck. From Brazil, as you will see by my commercial letter, we have again this week excellent news of the coffee market. The daily receipts had fallen considerably, the stock was reduced to a lower point than for a long time past, and if there was not a great deal of business doing at the moment, it was only because holders would not accept the terms offered by buyers. Nevertheless I am once more told on good authority that the quantity gathered this season will be much larger than was expected, and the only reason the receipts in Rio had fallen, off is that planters in the interior are keeping back supplies for better rates. From Santos, however, there comes intelligence of an opposite nature. There the present season crop was estimated a little while since at 1,500,000 bags, the average being a million to 1,120,000 bags, but it is now said that the out-turn will not exceed 800,000 bags.

COFFEE PLANTING.

G. M. writes to the *Madras Times*:—A correspondent from Travancore signing himself "A Coffee Planter," seems labouring under the idea that he is destined to effect a revolution in coffee-planting by some wonderful *modus operandi* or another, not yet quite revealed. I cannot compliment him on the clearness of his style of writing, but, as he does not say that he is an English Planter, I shall say nothing, on that head. The only change on the present mode of planting your correspondent would insist upon appears to be "stopping at once the disastrous operation of clearing by burning." But there is nothing very new in this, a strong burn has been looked upon for a long time back as a serious misfortune in coffee-planting—nevertheless people still go on burning, and I am afraid they will continue doing so for a long time to come. If you are prepared to double the ordinary expenditure for opening an estate, it is quite possible to do so without burning the jungle by heaping the branches and smaller trunks between the rows of coffee: but for the first three years it will be very difficult to work an estate opened in this manner. The only serious objection, however, to this way of opening a clearing is that regularly as the dry season comes round, you must be content to let your estate lie at the mercy of a spark. The theory of carrying all the forest off the land is very absurd; you might treat 10 acres like this at an enormous expense without any corresponding advantage; but in removing such a mass of vegetation of the land you would be really impoverishing the soil. If expense is no object, I would rather bury the stuff than carry it away. "Coffee Planter" prides himself on having made a discovery in leaf desease. He tells us that it is not the leaves but the roots of the tree that are diseased; but from "Coffee Planter's" own showing, I think, I can prove him wrong. He allows that when manure is applied to the roots of a tree suffering from leaf disease, the tree will at once respond to the application by putting forth beautiful fresh foliage. Now, if the roots of the tree were diseased, would or could the tree do this? It certainly could not. When the vitals or roots of a tree get diseased, or otherwise fatally injured, the tree will at once obey a law of nature, and instead of making useless leaves, will concentrate all its energies on making blossom and fruit, and it will readily yield up its own vitality in bringing that fruit to maturity so as to leave seed in the earth to carry on its kind after itself has perished. But, in leaf disease, the tree seems to be in no fear of extinction, and so is not particularly anxious to make either blossom or fruit; but prefers the easier task of making leaves Your correspondent seems to have great faith in what science can do for the planters: but as regard leaf disease, science has not been able to do anything for us so far. We sent to the chief Prophet at Kew, asking him to curse or otherwise destroy our enemy, or tell us how we might do so for ourselves. But instead of answering our request, Dr. Hooker, like the unrighteous prophet of old, went on prophesying worse and worse evils for us.

Your correspondent says that "a middle climate is necessary for European health," but I cannot see the necessity of the thing on the score of health alone. I would much sooner side with "Jim Crow," the red Indian, who considers the first necessity in any new location to be "good grub." The reason why planters are mostly to be found in a "middle climate," is because coffee is found to thrive best there. In conclusion, I may state my opinion that if self-interest in the hands of Englishmen is unable to devise a better way than the present of cultivating coffee, I am afraid the Government, however powerful, will be powerless to do so. But, in truth, there is little chance of the Government trying the experiment. If all we hear be true, the Travancore Government is just as likely to give a prize for every planter's scalp that is brought into Trevandrum.

COFFEE IN WYNAAD.

A COFFEE planter in the South Wynaad writes to the *Athenæum*:—The picking season will soon be over, but a good deal of the crop has yet to be despatched to the coast. In the Ouchterloney Valley with their large crops ripening faster then they can get them in, it has been necessary to resort largely to "stripping." In other parts of the South-East, in the Devalah and Cherambady Districts for instance, where it has been all along known crops were bad, many planters, nevertheless, were quite unprepared to hear of the wretchedly poor and simply envious out-turns of many of the estates. To quote two or three cases, the accuracy of which I can vouch for:—One well-known estate, but which by the way has not yielded a profit for the last half-dozen years, and which in the opinion of competent judges never will again, by the obvious reason of the land being steep and badly exposed—a reason, now of paramount importance, but which in the old days, strange to say, never appears to have had a place in the judgment of planters—the soil having in consequence, long since been washed away—this large place (250 acres in extent) gives a crop of five tons!! Another estate of the same size, is said to have given an equally fine crop, but I believe the real figure is eight, and not five! Another, 150 acres—5 tons! And several properties, ranging in extent from two to three hundred acres, have yielded crops ranging from ten to twenty tons!! while the yield from several others is a mystery, the proprietors or superintendents, deem it prudent apparently not to clear up. After this pretty statement of facts, I fancy I hear some one exclaiming—"that's a lively state of affairs, I thought coffee-planting was going ahead, you know we have heard so much about it lately." It is a "lively state of affairs" undoubtedly and a "pretty kettle of fish" certainly for many of the Devalah and Cherambady folk:—at the same time it is perfectly correct to suppose coffee planters to be going ahead—not in a Yankee-like, break-neck speculative sense, but steadily, surely, and successfully. It can't be helped now, if in the old days, forests were knocked down indiscriminately, the coffee plant "stuck in" the ground to grow as best it might, and men hunted the bison and elephant from one week's end to another. To these mighty Nimrods coffee-planting was a "fine thing" no doubt, as it is a "fine thing" in a different sense—to those who know how to go about it. But the legacies of the old order of things, in the shape of estates opened out in these palmy hunting days, are assuredly not "fine things," and that many of the old Nimrods—with a sigh perhaps for the jolly old times—and many of their successors, know to their cost.

The industry is changed altogether now, and things are done now in a more systematic and scientific manner; a new order of men, better trained and with fresh ideas, having, as stated, a new order of things, and profited considerably from the mistakes of former times. Only let now a fresh idea be broached, or an improvement suggested, it is wonderful how the merits of the one will be discussed far and wide, and the practical ability of the latter very soon proved. There are still old planters who fight shy of "new blood" and "new fangled ideas," but they have been playing a losing hazard, and well they know it, although reluctant to admit it. Remember I am not writing sentiment, but of a great change for the better that has been, and is still almost imperceptibly creeping into coffee planting. A well-known planter, of some twenty years' experience, taking a testy friend of mine round his estate the other day gravely remarked he believed there was good in manure after all! and at the same time pointed to a field, half of which had been manured some months before, and which of course presented a very marked contrast to the other half. In the same manner there are men who doubt the wisdom of systematic pruning, which of course is not nearly so bad, or extraordinary as a disbelief in manure—but it is bad enough. Good pruning is doubtless one of the most difficult accomplishments to attain to in coffee planting, and I don't think I shall be guilty of exaggeration if I assert on the strength of my own observations and the opinions of a great majority of planters, that success or non-success, good crops or bad crops, depend not so much upon manure—as upon good pruning.

"Every cloud has its silver lining" and "every picture its bright side," and if in the foregoing remarks I may have divulged very little of the silver lining in, and not much of the bright side of coffee planting as it obtains here, I am only reserving my duty to do so at a later date.

The weather at some time or another, is an object of interest to all agriculturists, and to us planters just now, and for the next few months it will be an all-absorbing topic of conversation. Many from their oracular utterances and prognostications might give to a stranger the impression of being in the confidence if not in the service—of that proverbially mythical being—the "clerk." I, for one, don't know "what's up" with that gentleman but the state of affairs has certainly been rather abnormal lately—cold and hot in a higgledy-piggledy fashion. One day the sky obscured by a mass of dark and threatening clouds—another day scarcely anything but a serene expanse of blue. On the 14th January a few cents of rain fell over a good portion of the district, not enough to do good but enough to do harm to a good deal of blossom, unless sharply followed by a good downpur, which at present there are no signs, I regret to say, of our getting. The blossom is unequally forward on most estates for the time of the year.

Cattle disease which had been bad in some parts of the district, is now disappearing. Prices of food-grains are still relatively high.

COFFEE PLANTING IN SOUTHERN INDIA.

THE rapid and wondrous spread of the cultivation of coffee in Southern India, together with the other great interests dependent on its future success, urgently require more than the the usual attention of both the Local and Imperial Governments. Coffee, which thirty years ago was a mere experiment has, by the unflinching energy of our countrymen, increased and is still increasing in such an astonishing manner as to promise at no distant period to cover every available spot in the Madras Presidency, not only in the Hill Districts but in the Plains, especially if the Liberian Bean answers to the expectations of its cultivators. This beautiful shrub promises to be to Southern India, what opium has been to Bengal, and to become the producer of the principal revenue of the country. The consumption is daily increasing and with the consumption, the demand, and shows symptoms of becoming greater if the American Government adopt the recommendation of its President to place on its importation, only half the amount of duty compared with that of tea. The Chinese also are showing a disposition for its general use as a soothing and healthy beverage in substitution for opium, because it exhilirates the spirits and strengthens the constitution, when both are suffering too much from the effects of the pernicious drug, the use of which the Government are doing their utmost to extinguish.

Should the use of coffee once take root in China also, the coffee growing-districts in the world under present cultivation would not meet the demand, for China cannot produce it and must import. Other fields will be sought for extension and both India and Ceylon will be the gainers, India in particular for her immense population (from which Ceylon and other coffee-growing contries are obliged to borrow) will find occupation at home by judicious legislation, and India will become the coffee mistress of the world. These are no far-fetched ideas or the chimeras of an over sanguine brain, but are facts made evident by the progress of civilization, the opinions casually uttered by the newly appointed Embassy from China to Europe who have observed the benefits of its universal consumption in the countries visited, and here at our very doors by the success which the cultivation is—extending. Many fortunes have been made and lost in the enterprise, as in all other mercantile operations, but it is evident that the former exceed the the latter, as is evidenced by continued perseverance. Those who know best, assert that no fortunes would have been lost if those who invested had obtained that support from Government which is generally accorded to all other new industries, There has been special legislation for cotton, tea, opium, indigo and others—for coffee nothing. On the contrary the planters complain that they have been not only neglected but have been restricted in their operations. But the time has come for special legislation on this subject also, and if refused by the Indian Government must be sought at the hands of the Imperial Parliament. Governors have been interviewed in vain. Promises and promises of "taking into consideration" have been made—to be forgotten. Lord Northbrook refused to interfere, and it is only lately that the Duke of Buckingham and Chandos ignoring the whisperings of a clique, apparently determined to listen to the remonstrances laid before him—but alas "Hope deferred maketh the heart sick", nothing has yet been done except the notification that "they are under consideration"—and there, they will in all probability remain. The humble worm will turn if trodden on, the faithful spaniel has been known to forsake his master if neglected; it will not be therefore surprising if those interesed in coffee tired of constant entreaty, should resort to demands or throw up their enterprize in disgust, to their own ruin and that of the State. We don't suppose that India can afford to lose the revenue on coffee any more than the people of England would wish to lose the comforts and advantages of its consumption, therefore a grave responsibility will remain with those who would bring about the catastrophy. The interview between the Viceroy and the Deputation from Wynaad appears to have had little other effect than all such have had heretofore, "what do they want"—said Lord Lytton afterwards—"what *do* the planters want" . . . . "as you are going down to the Wynaad about the Famine"—said he subsequently to Major Moncrieff—"just see if you can make out what they want, and ask what they have to say about unification." His Lordship at that time had, and at all times has, many important subjects to consider, and may be excused for not perfectly recollecting subjects that are not immediately under his attention. We therefore venture again to refresh his memory. The planters want good roads, a railroad if possible to take their produce to market, they want the telegraph through the District, they want a Labour Ordinance to protect them from dishonest *maistries*, and to secure for a permanency such labour as they can get, made binding on both employers and employès, which will enable them without risk to extend their operations. They want a special enactment against the robbers, and receivers of stolen coffee which inflicts no injury on the Government but will if not checked, ruin the growers, They want a local magistracy by whom culprits may be summarily convicted and adequately punished, not to be compelled as at present, to leave their work for days and travel great distances in all weathers, to attend the Court. We heard the other day of a Wynaad Solon sentencing a coffee stealer to fifteen lashes because he was young, then let him go to steal again. Why a boy in England is sentenced to two months' hard labour for stealing a single turnip, value one pie—or for taking a bit of houseleek, which is valueless, from the roof of a house! The kind hearted official referred to, sentenced a scoundrel who robbed a too confiding master, who had trusted and supported him for years, of Rs. 500—to two months or two weeks imprisonment only, because he had only spent four annas of the money before it was recovered by the Police. He did not take into consideration the fact of the villain having tied himself to a tree and wounded himself to support his assertion of having been beset by Dacoits, with the intention of decamping with the whole lump sum afterwards, not having had time to spend more of it before he was detected. They ought to be represented in the Legislative Council as in Ceylon, so that they may have a voice in all subjects appertaining to their own industry. They require an amendment to the rules and regulations for the sale of waste lands—that they may not be subjected to the vexatious delays which prevent intending planters from commencing at the proper seasons, and occasions much loss and disappointment; and they want all obstructions removed by the Mysore Government which are said to have prevented the immigration of coolies and importation of grain from that Province for which they send year by year, hundreds of thousands of hard rupees.

About the roads, the Madras and Mysore Governments have offered to pay two-thirds of the cost of all new roads constructed before the 31st May next. The restriction as to time being evidently to get such roads completed before the monsoon and available for traffic during the rains, besides Government wisely consider that after that time all disposable labour will be required on the estates. But the planters are not agreed on the subject. "Of what use"—say they "is the construction of new roads when you are unable to keep those in existence, in working order? Roads are matter for the Imperial Government and should be paid for out of Imperial Funds, for you benefit by them more than we do and we pay for their up-keep. Let the Mysore Government look to its own roads, which if attended to before, would have prevented all the horrors of the Famine, and let the Madras Government look to our roads by which it derives its revenue—or else let us make the roads and establish Toll Bars by which capital, interest and up-keep can be provided. Then every one using the roads will be equally taxed. And we think they are right. We believe that a law exists in Ceylon which makes it compulsory on any person opening a new estate to construct proper approaches, supplemented by the Government, and we think that some such measure which would make the expense fall on those benefited by their use, might be judiciously introduced into the coffee districts of Southern India, except for the construction of trunk roads and main thoroughfares, which should be made and maintained by the Government. That something must be done and that without loss of time, to put a stop to coffee-stealings which is becoming an established trade, is self-evident, otherwise when the law is enacted it will have the same effect as had the locking of the doors after the steed was stolen. Hundreds of cwts, are finding their way to the coast—not to the planters' account, and if punishment or detection is to be limited to simple flogging, painful as it may be on administration, it is soon forgotten and the receiver continues to pursue his nefarious business. Therefore hundreds of cwts. more will follow, unless Government quickly steps into the rescue.—*Madras Athenæum.*

LIBERIAN COFFEE.

SOME little interest has been excited, says the *British Trade Journal* by the appearance in the London Produce Market of the new variety of Coffee, *Coffea Liberica*, to which attention has been so much drawn of late. It is not an absolutely new product, however, small parcels having at intervals found their way into the London market, during the last ten years. They have passed unnoticed, and probably were a source of loss to shippers at Monrovia. Be that as it may, it appears that the collection of the berry has, until recently, been carried on in a half-hearted manner by the Liberians, and what quantity they did export went mostly to the United States where they esteem the coffee and pay a high price for it. In future it is likely that a good part of the available supply will be diverted to this country, and as the cultivation of the Liberian variety is engaging the attention of planters in India, Ceylon, and other parts, the probability is that in a few years this coffee will come into active competition with other sorts in the markets of the world. It is always difficult to estimate the intrinsic value of a comparatively new product, and first prices are apt to be misleading. We are informed that parcels of Liberian coffee had lately sold in auction and by private contract at from 100*s.* to 106*s.* per cwt., but as motives of curiosity have actuated buyers, it must not be assumed that these figures represent its real value. They are, in fact, fancy prices, and the opinion of experienced coffee dealers is that the Liberian bean will find its level alongside Java and native descriptions selling at about 90*s.* per cwt. We have a seen a sample of the coffee, which is remarkable for its size and the posibility of cultivation under climatic conditions which would prove fatal to the *Coffea Arabica*, or ordinary variety.

CINCHONA.

THE Burmah Forest department have been successful in securing over one hundred *viss* of cinchona bark, from their plantation at Tounghoo. Should the bark be pronounced good and sell readily, it will be an encouragement to the department, and those in charge to continue their exertions.

We are glad to see, that in our counsel to intending cinchona planters to confine themselves to the best varieties of the tree, we are supported by the Wynaad Association of coffee planters, who in reply to a letter from the Commissioner of the Neilgherries stating that seeds of *cinchona succirubra*, and *C. officinalis* were available for distribution from the plantations, it was resolved that Government be requested to obtain for distribution to planters a small quantity of seed of the more valuable kinds of *C. calisaya*, which it is believed would answer well in Wynaad.

IN 1859, says the *Ceylon Observer*, Mr. Thwaites first attracted attention to the probability of Ceylon, as well as India being adapted for the cultivation of the quinine plant, for a supply of which the British Government had, in that year, despatched Mr. Clement Markham to South America. Next year Mr. Thwaites selected the land now known as the Hakgalla Gardens as the site of the experiment, and early in 1861, a portion of the precious consignment of plants brought by Mr. Clement Markham to Bombay was transhipped to Galle and sent on to Hakgalla. So commenced the cinchona planting enterprise in Ceylon. For several years very little was heard about our plants, and certainly no one anticipated the development of a great planting as well as commercial success, and the cultivation was confined to the Peradeniya and Hakgalla Gardens. Indeed after the fitness of the Ceylon climate and soil for the growth of the plant was fully established and the success in India and Java became the subject of general congratulation, it took a considerable time to convince Ceylon planters that the cultivation of cinchona was worthy of attention as a commercial speculation. Mr. Thwaites had to ask coffee planters as a favour to give a trial to the plant on their estates, and great numbers were for several years given away from Hakgalla without charge to induce cultivation. This was the case between 1862 and 1867, when a demand first sprung up for plants, but it was even then very limited and desultory. Many put down a few *succirubra* or Red Bark kinds as ornamental trees around their *bungalows*, or along their walks, but few thought twelve or fourteen years ago that a great commercial value would, by this time become attached to these trees. Among the exceptions may perhaps be mentioned the proprietor of some of the first planted estates in Dikoya and Dimbula, who thus early planted groves of a few acres in extent, which, when cut down some years ago, yielded a handsome profit. In the case of Wanna Rajah, the suckers allowed to grow up have developed into trees, which will soon be fit for cutting again. Mr. William Smith, the well known Dimbula pioneer, tells with gusto the story of his earnest wish in opening Craige Lea in 1862 or 1863, to plant therein as many as 150,000 cinchona plants offered to him from the Government Gardens but his partners in the venture protested, saying that they wanted a coffee plantation and nothing else—thus throwing away the probability of owning ten years after 75,000 trees (half being struck off for failures or casualties) at Rs. 5 a tree or Rs. 375,000! That the calculation is not extravagant is proved by the results of several experiments. A similar amount per tree has been realized for trees which were put down along the border of an estate in Lower Pussellawa with the primary object in view of shutting out from public gaze, a field of poor or semi-abandoned coffee. Where any care has been taken in barking and drying, the result has been uniformly satisfactory so far as regards Ceylon cinchona. Samples of Ceylon bark first attracted attention in the London market in 1868 and a ton of bark sent home in the following year realized a price which at once induced a wide demand for plants. This increased so rapidly that from the 1st January 1872, a charge for Rs. 5 per 1,000 was made for plants at Hakgalla. The distribution in 1873 was 670,500 plants in 1874; 826,000 plants, in 1875, 791,500 plants, and in 1876, 196,000 plants.

Like tea, cinchona in Ceylon is grown at a variety of altitudes, and the belief that it will do well over 4,000 feet seems belied by the fine appearance of trees in some districts at 3,000, 2,000 or even 1,000 feet above sea level. It is not likely however, that the bark in the lower districts can be so valuable, or rich in quinine. Notwithstanding a considerable percentage of failures from canker, damp sub soil, or other mysterious causes, the growth of cinchona in the medium and higher districts of Ceylon is very satisfactory, and the progress made of recent years is truly wonderful, so that Ceylon bids fair to be the greatest cinchona producer—more especially of the *Succirubra* and *Officinalis* kinds—in the world. The former, the Red Bark, is especially adapted to the climate, and grows almost anywhere within the limits we have mentioned, while the *Officinalis* (Brown Bark) with a little care, does almost equally well from 4 500 feet upwards. This latter Mr. Thwaites specially recommended in the early days to the attention of planters, on account of Mr. Broughton's report that chrystallizable sulphate of quinine was so easily extractable from it. Of the finer species, the *Calisaya*, not many plants have been grown, although several attempts with seed got from Java are being made. In Ceylon (as in the Neilgherries where the late Mr. MacIvor, abandoned the attempt to cultivate this kind), *Calisaya* is not likely to find a congenial home, unless it be at our highest elevations, around Nuwara Eliya and Horton Plains. While nearly every estate in the younger and higher districts, as well as many in the other districts have their quota of cinchona trees, either along the roadside or scattered throughout the coffee, plantations of cinchona alone have recently been formed in Ramboda, Nuwara Eliya, Uda-pussilawa, New Galway, Dimbula, Matale and Ambegamuwa. The progress made may be recorded as follows:—

CINCHONA PLANTED.

	1867	1869	1870	1872	1873	1874	1875	1176	1877
Acres	50	100	200	500	1,500	2,000	3,000	4,200	5,578

CINCHONA IN THE LONDON MARKET.

OF all the new products to which attention has recently been turned, there is none perhaps which seems to promise so good a return to the grower as cinchona; and as a natural consequence, its cultivation has extended with marvellous rapidity during the last three or four years. During that time, a great deal has appeared in the local press relating to the various processes of culture; and the experience of our neighbours on the Neilgherries have been advantageously studied by those experimentalising with the quinine-yielding tree. Our knowledge of the article may now be said, to have passed beyond the experimental stage, so far as the selection of suitable soil and climate, the choice of variety, and the treatment of the plant, in its earlier stages are concerned; but we are still wanting in practical acquaintance with the best means of removing and preparing the bark for the London market.

Our London correspondent has more then once pointed out in his notices of public sales of Ceylon bark, the obvious want of attention to apparently trifling details in preparation, which nevertheless, make a considerable difference in the price realised; and we therefore, requested him to confer with the brokers chiefly engaged in the trade, and then give us the result in some simple suggestions for the future guidance of shippers. We have now before us a letter from him under date November 23rd, in which he says that he has interviewed Messrs Dalton and Young, Lewis and Peat, and Hale and Son, through one or other of whom all the Ceylon cinchona is sold, and he finds that though they are quite ready to put a price upon any sample of bark laid before them, they will not venture any opinion upon the relative merits of "mossing," "telting", or any other of the processes of cultivation, and of course, this was not to be expected—it is not their business. As regards preparation and packing, they offer one or two practical hints. Much of the Ceylon bark which now goes home is reported country mouldy, which means, that is not sufficiently dried before packing; the remedy is patent. Then as to sorting, our authority says, it is well to sort but not too closely, that is, don't reduce the parcels of each quality to infinitessimal proportions. This has been done to some extent hitherto, and, of course, it is impossible, in many cases to carry out the sugestion which follows, that it should always be packed in cases of about 100lbs., because the quantities shipped are often so limited in extent. But our correspondent explains how the employment of small packages militates against the price. The big quinine makers won't trouble to test the little lots. Then there is a word against the use of bags. The bark gets so broken in them and though this doesn't matter much to quinine makers, who look to other things than appearance, the druggists, to whom much of the Ceylon necessarily goes, for the reason above given, do not take kindly to the broken pieces.

Great care should be taken in order to secure well seasoned wood for the cases in which cinchona is to be packed, as the bark, especially if not thoroughly well dried previous to being packed, is apt to absorb damp from the wood if the latter contain any. It should be borne in mind that in the case of bark of some little thickness, it is not always easy to determine if it be properly dried. It may be so apparently, and yet may contain the germs of mouldiness within, and this is very often likely to be the case with bark from the more elevated districts of Ceylon, where in many months of the year, the sun has not much drying p[illegible]. It would be preferable, in most cases to give the bark a further drying in Colombo, if the weather be favorable, and the actual degree of dryness may be ascertained by frequent weighings of a small portion, when the loss by dryage could be ascertained from time to time.—(*Ceylon Times*)

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

Monthly General Meeting held on Thursday the 13th of December 1877

ACCLIMATIZED seed of Carter's "Greengage tomato" and of the "Golden butter bean," were received from Capt. J. I. Pogson.

Capt. Pogson states that this tomato is the produce of imported seed raised last year and resown this year. "The fruit is fully equal to original stock, and as regards size many of the tomatos produced this year were larger than the photographed engraving printed on the London seed parcel." In respect to the beans, Capt. Pogson adds—"of all the beans I have as yet grown, this is out and out the best. The cooked pods are eaten whole without any peeling or slicing in the cookroom. They are ready for the table in six weeks after sowing. I allow one tea-spoonful of pounded calcined bone to each dibble, and put two seeds in each distance between dibbles, centre to centre nine inches. One chittack of saltpetre was mixed with 16 chittacks of bone powder, and water poured over to moisten all and dissolve the nitre. When dry the manure is ready."

Also a parcel of Tonquin beans (*Dipteryx odorata*) from Demerara. From Messrs Hobson and Edo.

The Secretary intimated that the majority of this supply had been transferred to the Director of Agriculture, N. W. P., at whose requisition it was obtained, a few sent to the Royal Botanic Garden and to the Society's Garden, and a small quantity of Arnotto [illegible] (*Bixa orellana*) from Monsr L. Voisson, engineer to King of Burmah, Mandalay. M. Voisson states that the colouring property of the Arnotto raised at Mandalay is superior to that raised elsewhere.

The Secretary placed on the table several pods, recently gathered, from the few plants of Bahmie, (Egyptian) cotton raised in his garden from the seed kindly presented in June last, by Mr. Chapman, Agent to the P. and O Company at Alexandria. This cotton possesses a long and strong fibre. Full particulars will be furnished in due course.

Provision of Vegetable and Flower (seeds for 1878.)

The Special Committee, appointed by the Council, to arrange for the supply of seeds for next year submitted their report. The Committee [illegible] to remark that several complaints have been received in respect [illegible] consignments of seeds in 1877, more particularly those from Messrs [illegible] Landreth and Sons of Philadelphia. The seeds from Messrs. Vilmorin, Andrieux and Co of Paris, especially the flower seeds, have not been reported to be so good as usual. Messrs. Haage and Schmidt, of Erfurt, have behaved in a most unaccountable manner, as already intimated [illegible] to members in having violated their promise of despatching, in due course, the annual consignments of flower seeds.

The Committee propose that an order be given to Messrs. Sutton & Co., of Reading, in place of Messrs. Landreth, and to Messrs Platz Brothers, of Erfurt in place of Messrs. Haage and Schmidt, consignments to be again ordered from Mr. Buist of Philadelphia, and Messrs Vilmorin, Andrieux & Co. of Paris. A consignment of acclimatized flower seeds from Lucknow, and field seeds from Melbourne. The report was adopted.

In connection with the above, the Secretary read the following note regarding certain kinds of flower seeds raised in his garden:—

Several members having complained of the flower seeds imported this year from Messrs Vilmorin, Andrieux & Co of Paris, I think it is as well to give the result of my sowings. On the 2[illegible]th October (but too early in the season) I sowed in pots the following 8 kinds:—Petunia, Phlox, Heartsease, Portulaca, Daisy, Geranium, Mignonette (large flowered variety) and Violet. With the exception of Violet, all these germinated fairly, the Petunia and Portulaca freely.

On the 16th November I sowed the following 5 kinds:—Lupins, Nigella, Carnation, Nasturtium, and Dianthus. These germinated still more freely.

On the 26th November I sowed 5 other sorts, namely:—Tagetes, Phacelia, Antirrhinum, Cineraria, and Browallea. These have germinated most freely, as the pots now placed on the table will shew. We have had an unusually warm November or, probably, those sown in the middle of the month might have given still better results. As a general rule, founded on many years' experience, I am of opinion that the majority of our imported annual seeds, Mignonette, Aster, Sweet peas, and one or two others excepted should not be committed to the soil before the 10th or 15th of November under ordinary seasons, but still later this year; November having been, as already remarked, so unusually warm.

Thus it will be seen that, out of 18 kinds, 17 have germinated, some partially, others freely, Violets the sole exception, being difficult to raise from seed except in a hot bed.

I may add in conclusion that my mode of raising these seeds has been simply as follows:—

First to make the soil fine, moistening it previously,—after sowing the seeds, cover them with still finer soil through a sieve. Place the pots in a shady place during the day, but removing them into the open at night for the benefit of dew. Shortly after germination remove the pots, first to a part of the garden where they can get the benefit of the morning sun, and afterwards to a more exposed place, to strengthen the seedlings preparatory to b[illegible] [illegible] in open beds or in larger pots according to kinds. The majority of annuals, with exception of Mignonette, Pink, Linum, and Larkspur, should in the first instance, be sown in pots, and afterwards transplanted.

Floral Notes.—The letters next read had reference to the violet plants, presented by Mr Francis and to a cheap and efficacious mode of transporting plants from one part of the country to another. Mr Francis writes as follows, on the 13th November last:—

"I brought a quantity of plants with me from Naini Tal. As the boxes full of earth which I brought down last year cost a great deal, I made up my mind to economize, and shook off all the earth this time, leaving the roots quite bare and simply wrapping them in damp moss. The result was that I brought down a goodly number of plants in a basket two feet broad, and the heat of the train inside the damp moss act like a hot-bed, so that each plant emitted several fresh roots. I potted them out two days after arrival, and every plant is well and thriving. The Fuchsias in particular, look wonderfully well.

"I am simply overburthened with Violets, and I am giving them away right and left. It is wonderful how they increase, and multiply here.

"Last year, I brought down two plants of the light purple primrose. They were put in a shady place to the north of my house and flowered beautifully at the commencement of the year. In spite of the extreme heat this year they have survived till now, and by dividing the roots, I have now got sixteen healthy plants. Would you like a plant or two for the Society? If so, I shall be glad to send them down next month, by which time they will be fully established. If you want any Violets, I can let you have fifty plants at once."

In a subsequent letter, Mr Francis adds—"I have sent a basket of Violet plants. These are enough to form the nucleus of a good stock, but I can easily send you more if required.

"Each lump of plants represents the increase from five plants—These were all that I put into each pot about a year ago and you can judge for yourself how they have increased and multiplied. Each rooted plant should be separated from the clump and planted out either in the open ground, (with a northern aspect and shaded from the midday and afternoon sun) or in pots. The roots should be cut to a length of not more than 2½ inches, and the plants should be put down about three inches apart. This treatment should be repeated each year as soon as the cold weather sets in, and the plants will flower profusely. If (as is too often the case) Violets are left to themselves year after year, they become pot-bound, and yield a few miserable looking flowers; whereas if they are treated in the mode which I have described, they thrive wonderfully. I have given away hundreds of plants, and have still a very large stock, though many plants perished from the extreme heat this year. All these plants have sprung from about twenty, which were given to me three years ago. They were then at the point of death, as the pot containing them had been left untouched for some three years.

"I can let you have a pot of Primroses in a month or so. They came down from Naini Tal last year, and have multiplied two pots into ten, in spite of the hot weather."

Proposed extended utilisation of the Singhara Nut.

The following remarks, dated 10th November, by Capt. Pogson on the above subject were next submitted:—

"The publication of agricultural suggestions, in the proceedings of the Agricultural and Horticultural Society, are productive of so much good that I am induced to ask you to utilise the subject matter of the enclosed letter published last October in the *Delhi Gazette*.

"With the example of Cashmere before us, it does seem very singular that the vaunted tanks, large lakes, and inland fresh water sea of the Madras Presidency, as well as the immense *jheels* of the North-Western Provinces and Oudh are not, as a rule, turned to most profitable account, by being placed under *singhara* cultivation. The dried nuts will I believe, keep for years, and as arrowroot or rather *singhara* starch will always sell in England, either as food or for manufacturing purposes, all old *singhara* stock could be so converted and sold.

"It would I think, be advisable to publish in the Society's proceedings, how to plant the water-nuts, and as annual extension of the cultivation spontaneous and artificial, is a very simple affair, the Madras Government would, in a few years, find themselves to be the proprietors of very valuable *singhara* nut plantations. In the N.-W. Provinces and Oudh the systematic deepening of jheels by dredging machinery, worked by manual labour, would very soon give a general depth of three feet of water, and the excavated soil being systematically deposited on the sides of the *jheel*, a regular *bund* or embankment would be formed which, if strong enough, would keep in all rain water, to be utilised on their cessation for purposes of artificial irrigation. The Government is by law sole proprietor of all flowing and non-flowing water; hence the suggestions made cannot and may not be undertaken by 'private enterprise,' and if neglected, every year of drought or famine will run the State heavily into debt; whereas by taking a leaf out of Cashmeer's book, a very large supply of wholesome food may be annually produced for a song, and if not immediately wanted, may be dried and stored and sold at discretion to the European or Parsee starch manufacturer."

In a subsequent communication of the 3rd December, Captain Pogson continues the subject:—

"As my communication on the subject of *singhara* cultivation was too late for your Society's meeting, held on the 12th November, I have thought it advisable to supply some further information.

"To begin, I have sent to your address by this day's *banghy* post, a small quantity of uncooked, sun-dried *singhara* nut kernels. In the parcel you will find four kernels, nearly black on one side, and not so dark coloured on the other.

"This result has been attained by soaking the kernels, for a few minutes, in an aqueous solution of sulphate of iron. The object in view being to prove that the skin covering the kernels is rich in pleasant-flavored tannin, and as iron must be present in the tough leathery shell of the green nut, and also in the kernel, it is more than probable that the latter contains all the food 'phosphates,' duly associated with starch and gluten. Hence it follows that, like the grain of wheat, the kernel of the *singhara* is capable of sustaining life for an indefinite period, and is palatable, whether seasoned with salt and pepper, and when made into porridge with sugar, *goor*, or jaggery. If the kernels are broken into small bits, they may then be ground into meal in a hand-mill, and the produce may be kneaded up into dough, and made into small *chuppatees*. If the kernels be soaked overnight in cold water, next morning a single boil converts them into cooked food. Steaming would do as well, perhaps better, but I have as yet only tried the soaked kernels in the boiled state. I have—ears ago eaten *hulwa* made of *singhara* meal, and it was more palatable than that made from fine wheat flour.

"The price of the dried nuts, *this year*, is four annas a seer in the Simla bazar, and two annas in Umballa. The consumers and purchasers are natives exclusively.

"I presume, when cheap, the price would be that of wheat, or over 20 seers for a rupee.

"I find that as an average, a full grown nut kernel weighs 65 grains, which gives 14 of them to the *chittack* of 900 grains, and 224 to the seer of 14,400 grains Troy

"In the last *Indian Agriculturist*, at page 354, is a paragraph on SINGHARA-CULTURE as carried on at Indore. In it is stated that:—"The rent paid for an ordinary tank by the cultivator is about Rs. 100 a year."

"If the dimensions of the tank had been given, a rough calculation might have been made of the produce per acre of water's surface.

"The shells of the ripe *singhara*, when removed, would, I think, yield a good manure for most crops and when the cultivation of this valuable water nut is once fairly established, Government will always have a reserve of food and money in hand. At present the *bunneahs*, by acting in concert, can easily charge famine prices on food grains. But with large stores of dried *singharas* in hand, and the crop growing on the water's surface, the *bunneah* may be most effectually kept under control, and check-mated if needs be.

"The Ganges, Jumna, and Punjab River Canals, have produced water logged lands, and fertile-lands sterilized by sulphate and muriate of soda called 'khar,' and 'kuller.' Genuine 'reh' lands are fertile for 'reh' proper being a crude carbonate of soda is of value as a mineral manure, and doubly so, when it is associated with saltpetre.

"The fact of genuine 'reh' being quite another thing, and distinct from 'khir,' and 'kuller,' is practically demonstrated by old women and village *dhobees* washing dirty ugly clothes in soil impregnated with 'reh,' and called 'reh mittee.' The saponification proves the presence of carbonate of soda in ample quantity, and a simple but certain test is provided for distinguishing 'reh' from 'khar and 'kuller.'

"It appears to me that if water-logged lands were embanked, so that four feet in depth of water could always be retained on their surface, that these at present, hopelessly unproductive lands could be made to yield very paying crops of *singhara*.

"The 'khar' and 'kuller' lands, if similarly embanked and kept under water for, say, two or three months before the *singhara* sowing season sets in, might become sufficiently sweetened to grow the *singhara*; and as it is, these soils which produce malaria and fevers, by keeping them permanently under water, future salubrity might be secured, and a paying food-crop as well.

"The common Indian name for fevers is 'Bokhar,' a compound word meaning smell or effluvia from sulphate of soda *i. e.*, 'boo,' a bad smell, 'khar,' alkaline, or saline matter, and it is not a little strange that the medical officers who have investigated the source whence fevers are produced on the coast of Africa, have affirmed that such fevers are due to the inhalation of a gas evolved from the decomposition of vegetable and saline matters.

"As regards the canal water-logged lands, the embankments once properly and strongly constructed, they would be permanently available for *singhara* cultivation, and as fish of good size and quality may be reared in less than three feet depth of fresh water, the suggestion, if carried out, would bring grist to the State mill, and wholesome food and fish to the *zemindars*' and *ryots*' doors."

The following are the particulars inserted in the *Delhi Gazette*:—

"In your impression of the 12th of October you have reproduced from the *World* (newspaper) an article headed. 'Why are not Indian Famines Prevented,' and from its perusal I learn that the Madras Presidency possesses some magnificent ancient water-works which are described as follows, *viz.* :—'The Viranum tank, with its area of thirty-five square miles, and its embankment of twelve miles; Cauverypauk tank, with its embankment of four miles, rivetted along its entire length with stone; the Chembrumbankum tank, looking like a picturesque inland sea, are of unknown antiquity."

The first of these artificial lakes equals 22,400 acres of surface; and the third, being compared to an 'inland sea,' may be ten times that size.

"I have in a former paper drawn attention to the remarkable and very important officially authenticated fact, that in Cashmere THIRTY THOUSAND human beings are for five months out of the twelve fed and sustained on the *singhara*, or water-nut (*Trapa bispinoso*) of India, and if the *picturesque inland sea* under notice is at all deserving of the name, its bed and water surface might be most profitably utilised by being put under *singhara* cultivation.

"The *singhara* harvest will soon commence in the plains, and if a sufficient quantity of the nuts be secured and sent by rail to Madras, the tank of 35 square miles might become a first-class nursery for supplying seed-nuts to all Madras. The productiveness of the water-nut per acre is at present unknown; but supposing the yield to be four quarters (480lbs. each) of nut kernels per acre, then the 22,400 acres will give 43,000,000 pounds of food, and at sixty pounds per adult per month, the above quantity will suffice to feed 716,800 human beings for one month, and 1,43,360 adults for five months.

"The cost of this large and perennial supply of food would be a mere trifle. There are 4,000 square land yards in one acre, and allowing one seed-nut to each the price of the nuts and railway freight may be easily calculated. The first year's harvest will more than cover all cost, and thereafter in perpetuity a harvest will result, which would only have to bear the cost of watch, ward, and collection. The entire crop being State property, a very considerable revenue would be derived from the sale of the nuts, even if the kernels were sold at half the price of rice or other grain.

"In good seasons the agricultural population would freely use this cheap and nourishing food, and sell and export rice crops, &c.; and in bad seasons of famine, the growing crop of water-nuts would be a stand-by. In fact their presence would go far to prevent the artificial production of local famines.

"The nuts once sown, re-sow themselves, and in this way the square land yard might soon be growing nine water-nut plants or more, per square land yard.

The *inland sea* when covered with these nuts, would be a source of wealth to the State, and the people would be greatly benefited. Immediate action and a judicious liberality, is all that is needed to carry out the measure."

Reana Luxurians.

Several communications were submitted in respect to the above grass.

Mr. W. C. Barshore, of Shapore Oondee, Tirhoot.—"I am glad to inform you that my *Reana luxurians* has perfected its seed; I have but one plant and have got 1½ lbs. of good seed from same. The seed on the other plants has not ripened yet. The time for the Reana to flower seems to be the same as when the Tirhoot Genera flowers. Natives will readily cultivate it as a fodder plant, as I have been applied to for seed by those who have seen my cattle eating the grass. The cattle themoselves seem to be very fond of it as I had great difficulty in keeping away a braminee bull who came at night to feed."

Mr. James Carey, of Indore.—"Last year I think you very kindly sent me a packet of the *Reana luxurians* grass seeds.

"It has grown splendidly in may garden, is now in seed, height over seven feet. The drawback is, it requires irrigation; the tufts commenced to dry up very soon after the rain ceased, and since I commenced to give them water, they are springing up with fresh vigour.

"My cows eat it readily, and I have no doubt when I mix it (chopped up) with the leaf of the 'Prickly Comfrey,' which also grows well in my garden (and which cattle will not eat) I shall get a very nutritious food."

Mr. Francis Halsey, of Madhopore, Punjab.—"I saw in a late Garden Report that your *Reana luxurians* had shewed no signs of flower; mine is now in full flower. It is evidently a species of Indian corn. The male flower at the top of the stalk, and a cob forming at every joint of the stalk but I much fear it will not have time to ripen its seeds up here before the cold sets in It is a very open season, however, and I hope for the best. Lower down India it should succeed admirably, and should turn out a very valuable introduction."

Capt. J. P. Pogson, Simla.—"I have now the pleasure to inform you that out of 12 plants of *Reana luxurianis*, raised from seed sent me by you ten are coming into flower. The two plants not in flower were transplanted to fill up two vacancies caused by my having given away one plant, three feet in height, and having cut the other up into eight parts with roots attached for propagation. All these, as well as two suckers removed from a vigorous plant, have struck, and I have accordingly 22 plants. Of those coming into flower, one has thirteen spikes, another seven, and none less than two. If the present weather continues, I think the flowers will mature and ripen seed. But a sudden frost may knock all my trouble and anticipations on the head."

The Secretary placed on the table a quantity of seed—about three pints—gathered from a few plants in his garden,—thus showing their abundance of yield. There will now shortly be sufficient in hand for general distribution next year. He had just sent a supply to the Revenue Commissioner, Southern Division, Poonah, on the requisition of the Department of Agriculture and Commerce.

A. H. BLECHYNDEN,
Secretary.

THE AGRI-HORTICULTURAL SOCIETY OF MADRAS.

PROCEEDINGS of a meeting of the Committee of the Agri-Horticultural Society of Madras, held at the Gardens on Wednesday, the 5th December, 1877.

I. Read Resolution, passed in circulation, that an advertisement be published calling the attention of intending competitors for the prizes offered for tea, to the rule that the samples were required to be sent not later than the 15th December, and also to the rule that coffee and tea are not to be sample specially selected but the average quality produced on the estate and manufactured for general sale.

Resolved, that this resolution be confirmed; and that the question whether the rule as to the samples being of average quality should be maintained, be considered on the revision of the prize list.

II. Read letter from James Fowler, Esq., dated Varlavachan Estate, Palghat, November 8th 1877, forwarding a dry specimen of a common plant on the Hills in his neighbourhood, and requesting that he may be informed what plant it is, and whether it has any known medicinal value, as it appears to him to be a gentian and to have a powerful bitter tonic, and that it might be useful as a tonic, or in cases of malarious fever.

Resolved, that Mr. Fowler be informed that the plant is *Ophelia corymbosa*, belongs to the gentian family, is nearly allied to the medicinal species of Ophelia called *Chiretta*, and would form an excellent substitute for that drug.

III. Read the following extract from a letter from Dr. E. Eyre Lloyd, dated Tanjore, 15th November, 1877.

"I am glad to say the Liberian coffee plants you sent me two or three months ago are flourishing with one exception, which died within the first week of arrival. The other five are doing well. They do not appear to grow very fast, but they are looking very healthy and throwing out new leaves. They are still in pots, but in the open all day exposed to the sun, when we got it, and the rain day and night. They are under a foot in height. Should they still be kept in pots, or would you advise my putting them out? I believe they do equally well exposed or sheltered."

Resolved, that Dr. Lloyd be thanked for his communication, and that he be informed that the Committee would advise the plants being kept in pots, provided they are large enough, as long as this can conveniently be done.

IV. Read the following letter from J. T. Fergueeson, Esq., dated Calicut, 2nd November, 1877 :—

"I should be greatly obliged if you could obtain for me from five to ten pounds of cinchona seeds from Java trees, as I imagine the variety which grows there will be found more suitable to our low ranges than the high grown Neilgherry kinds."

Resolved, that Dr. Scheffer of the Botanical Gardens, Bintenzorg, Java, be requested to procure and send the Society a small packet of the seed required.

V. Read the following extract from a letter from W. Lee Kirby, Esq., dated Brooklands, Coonoor, November 22nd :—

"I have made this week a few pounds of different sorts of teas which I intend sending to the Paris Exhibition, and as the teas will be in two cases with glass at the top, I shall be very pleased to send them to you should you like to expose them at the Madras Show (not for competition) previous to my sending them on to Paris.

"I should be much obliged if you would kindly inform me whom the samples of produce intended for the Paris Exhibition should be sent on to Madras, and perhaps you may be able to let me know whether any forms have to be filled up."

Resolved, that Mr. Kirby be informed that the Committee are much obliged to him for his offer, and will be glad to receive the two cases of tea for exhibition. The Committee have been unable to ascertain what arrangements have been made for forwarding samples of produce to the Paris Exhibition. The Governor of Pondicherry, in a letter to the Vice-Consul at Madras, says :—"Il doit exister á Madras ou á Calcutta sans doute une Comité pour centraliser les products de cette presidence ouvue de son concours a la grande solemnité de 1878;" but no such Committee appears to have been as yet appointed. A Central Committee exists at Pondicherry, but is only empowered to deal with products of a French Colony, which have to be forwarded to "la section coloniale," whereas Mr. Kirby's tea should be sent to the "Section Anglaise, presidee par le Prince de Galles." Dr. Bidie, as superintendent of the Government Central Museum, is making a collection for the Exhibition, but the orders received by him do not contemplate the reception of specimens from individuals. He will ask Government whether it is intended that he should receive such specimens.

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THE INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

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NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

GREEN JOWAR AS CATTLE FODDER.

TO THE EDITOR.

SIR,—Your correspondent, J. SHORT, writing from Madras, in answer to my letter on the above subject, quite agrees with you regarding my being led astray as to the worm said to be formed on the jowar plant. The fact is that the worm is found not on the jowar plant as your correspondent says, referring to moths and caterpillars, but *in* the very *pith* of it. Perhaps the moths and caterpillars may not prove in any way injurious to cattle, but the particular worm or caterpillar, hatched within the jowar is the deadly worm I referred to as fatal to cattle.

Has your correspondent seen such worms in the Jowar plant? The jowar plant, with the worm in it, may be easily distinguished from among the rest without it. The middle leaf of the plant turns yellow and parches up, and the worm can be found by uprooting the plant and tearing it asunder; one or two small worms are sure to be within the very core of the tender stem. You must have noticed the worm in the plant I sent with my first letter on the subject.

In the second part of the letter, he says :—" I have given the subject much attention, and can affirm that the jowaree is rich in saccharine matter before the ear is pushed out, and cattle devour it, when they can, rather greedily without due mastication, and it readily ferments in the pouch of the animal, and gives rise to the disease known as *Hove* or *Blown*, and if not relieved the animal dies " asphyxiated." Granted; but if this be the sole cause of death to the cattle that devour the rich saccharine matter with the green jowar, allow me to ask your correspondent a simple question, and that is—whether the green sugarcane-tops contain a greater percentage of saccharine matter, or the green jowar? During the sugarcane season, when the rude Indian machine is at work, all the cattle belonging to the owner of the sugarcane field are fed throughout the season, for more than a month, on sugarcane tops, with the leaves on, and not a single case of death has ever been recorded, nor has it ever come to my notice. On the contrary the cattle grow into fine condition instead of being blown to death by the disease *Blown* your correspondent refers to.

If the rich saccharine matter of the green jowar plant be the sole cause of death to the cattle that devour it, why should the same cattle, being fed, for months and months, on a plant containing twenty times more of the richest saccharine matter, and which they too greedily devour without due or sufficient mastication, be not in any way affected?

Pope has wisely said, " our opinions like watches are, none go all alike, yet each believes his own."

S. JEVANJEE.

BEED,
February 8th, 1878.

BAMBOO AS PAPER STOCK.

TO THE EDITOR.

SIR,—Regarding your journal as the Indian agriculturist's organ (amongst whom, I am sure, you will admit the peasantry of this country), I would beg for your aid on the behalf of the cultivators, the *poor* cultivators, and there are no others, to protest against the indenting on this country for bamboos, wherewith to manufacture paper. It is but natural that such enterprising men as Mr. Routledge and others should view the country as a furniture dealer might a well furnished house, but we expect better things of a Government in the nineteenth century. Is our Government aware of the yearly increasing difficulty the cultivators on the plains in this country experience, in building their poor little dwellings? Is the Government aware that bamboos form the main material with which the cultivator builds his little house? We have a Bengal Civilian at the head of our Government, and he has been amongst us sufficiently long to know that a Bengal ryot's hut would not stand one downpour in this country. He should know that the bamboo is as indispensable to the poor cultivator (not the poor of the seaport towns) as the clothes he wears, and he should know that since the Burmese peasant's friend left the country, bamboos have increased in price four times. Of course different prices rule at different places, but take a given tract where bamboos were sold at eight annas per hundred, when that eminently wise administrator, Sir A. Phayre, ruled this country (as it never has been and we fear never will be again), the same article is difficult to be had at two rupees per hundred! And now they are about to raise a revenue on bamboos!!

ANGLO-BURMAN.

NOTE.—We publish *Anglo-Burman's* letter, but do not see the force of his argument. There is no proposal on foot to raise a revenue from bamboo, and we are quite certain that, were Mr. Routledge to undertake the utilisation of bamboo as paper-stock on a large scale in Burmah, the advantages to the province generally, and to the poor cultivators in particular, would be greater than the disadvantage of the increase in price of the raw material, which our correspondent anticipates, *Anglo-Burman*, in stating that since Sir A. Phayre's administration the price of bamboo has risen 400 per cent., should not forget that the value of agricultural produce has risen in the same, if not greater ratio. The utilisation of bamboo as paper stock is an enterprise which deserves every encouragement, and is a step towards the development of our resources. Our remarks regarding it have been discouraging, because we entertain serious doubt as to whether it would financially be a success, and because we desire to draw attention to equally suitable raw material, which at present is totally useless to any body,—ED, *I. A.*

IRRIGATION WELLS.

TO THE EDITOR OF THE "PIONEER."

Sir,—The subject of wells for irrigation has of late attracted so much interest, that I would ask room for a few observations meant to show the value of some easily portable boring apparatus, to ascertain sites where wells might be sunk with the best results, and to pierce subterranean obstructions more effectively than is possible with the appliances ordinarily available in a village, or even in a district. In a certain tract, not hitherto benefitted by canals, irrigation wells are of two classes—(1) in which the water lies in the subsoil, and is not pressed down by an impermeable stratum; these wells contain a supply varying with the seasons and as a rule are quickly exhausted, being sometimes worked out in a few hours: this water (locally called *choya* or *choycha*, *i.e.* percolation water) is generally in sand or loose soil, and the wells are liable to many accidents. (2) Wells which are filled by water welling up through a layer of clay such wells are not affected by change of season to the same degree as class I, and they seem often practically inexhaustible. At one of them several buckets and pairs of bullocks may be kept going day and night; whereas a well of class I, may become useless for hours after a single pair of bullocks has been working at it part of a day. Class II wells are also of a much more permanent character. In some places this clay bed is met with regularly; but at others only here and there; it also, when found, often varies much in thickness. In one village a masonry cylinder (*a*) had been sunk nearly 80 feet, yet clay was not reached, and the owner had little hope of reaching it. The *choya* water level was 29 feet from the ground surface, and this water filled 21 feet of the well; but sand had come in from below and occupied 27 feet above the curb. Though 21 feet of water stood in the well at the time of my visit, steady work lowered it rapidly. 200 yards off the clay was reached at 21 feet below the *choya* level; it was 7 or 8 feet thick, and was successfully pierced, and a good well (*b*) of class II obtained, which had been in use some 30 years. A little further on *kunkur* mixed with clay appeared with 6 feet less sinking, and a good (*c*) spring was tapped after perforation (6 feet) At a fourth place (*d*) in the vicinity excavation had been carried down to clay, but the bed was so thick, as to defy all attempts to get through it, and make a vent for the spring. An apparatus of the sort I have described should be of great utility, not only to projectors of new wells, but also for the improvement of old ones; it might, for instance, pierce the clay in (*d*) and reach it in (*a*), or at all events satisfy the well owner of its existence or non-existence at a reasonable depth, and enable him to judge whether further deepening would or would not entail the throwing of good money after bad.

OFELLUS.

NOTES FROM CASHMIR.

(FROM OUR OWN CORRESPONDENT.)

CASHMIR is now in the midst of winter, and there remains little to put one in mind of "the Happy Valley;" frost and snow we have had for over a month past and can be enjoyed, but with these and no made roads, travelling is most miserable work. The season has put me in mind of holly, but I have not seen any in the Valley. Mistletoe we have in abundance, and is most common on the walnut. I have counted as many as 50 and 60 bushes growing on a single tree. Where walnut-trees are not general, it claims support from the apricot, on which it thrives with less luxuriance. It is sometimes seen on the topmost branches of the elm, and once I observed it growing on the willow. Excluding the low hills and mountains, the valley does not present a great variety of trees; one of the chief landmarks are the groves of *plant* trees, they are noble specimens of trees, and some of the largest frequently measure in circumference, at 4 feet from the ground, from 35 to 40 feet. I have run the tape round one, 42 feet, and many more I found larger. The *plants* seed freely, but are chiefly propagated by cuttings. The wood is used for *papier machie* work, and is eagerly sought after to burn in the fire-place, owing to its giving off a good heat and little smoke, and its fumes do not affect the eyes as Deodar and other wood. The elm tree has the largest trunk of any that I have measured: one was 52 feet in girth, 3 feet from the ground, and I could have gone inside it on horseback: others I have found to be over 40 feet. Some of the trees are fine, but they are not so as a rule; after attaining their accustomed height, they commence to decay in the centre. It is usual to top many of the *plants* before the leaves fall to secure the fodder for the sheep in winter: The poplars are a notable feature in the Valley, and, planted for ornamental purposes, they grow to great heights, after which decay sets in, and they soon fall, often without the least warning. "Celtio Caucasus" is a small tree from 20 to 30 feet high. It forms a symetrical round head and has a neat and agreeable appearance, when in leaf; it is venerated by the Mussulmans, and commonly planted by them to beautify the grave yards. Besides the willow and fruit trees, there are only single specimens here and there of other species to be met with.

Previous to the 28th December, we had two and a half months' rain and snow, a total of 30 inches 72 cents; such a season can scarcely be remembered. It has done a great deal of harm to every thing; the rice crop has suffered the least. Maize straw is the best fodder in the valley, but the zemindars complain at so much of it being completely rotten; cattle have died in great numbers and will continue to die until we get spring here. The chief operation is knocking the paddy out of the sheaves by beating the heads over blocks of wood.

The weather since the 28th December has been fine, with a little more sunshine than dull weather; hard frost at night, which has kept the snow on the ground and prevented the grain and straw from drying.

	TEMPERATURE		RAINFALL.	
	November	December	November	.. 11 inches 23 cents
			December	.. 11 „ 79 „
Highest maximum	54·	47·		
Lowest do.	35·	35·		
Highest minimum	44·	38		
Lowest do.	31·	24·		
Average maximum	47·33	35·71		
Do. minimum	35·46	33·93		

The Indian Agriculturist.

CALCUTTA, MARCH 1*st*, 1878.

DEEP CULTIVATION.

MR. BUCK'S note on Colonel Corbett's pamphlet has elicited some remarks from a practical farmer, Mr. Benson, M.R.A.C., disposing of most of the difficulties which Mr. Buck thought would have to be overcome before a general introduction of deep cultivation into this country was feasible. The tenor of Mr. Benson's letter, which we take from our Allahabad contemporary and publish below, rests evidently on a misconception of Mr. Buck's intention in mentioning, in his note, some of the difficulties standing in the way of using English ploughs in this country. Mr. Buck, we are assured, is most anxious to encourage deep cultivation, and, as appears from his note, appreciates fully the advantages which the ryot, in the first instance, and the commonwealth in the last instance, would derive from a substitution of deep in *lieu* of shallow cultivation.

The difficulties, he mentions, are not such as would make deep ploughing in this country impossible. Even if existing to the extent Mr. Buck believes, they would merely tend to retard the general introduction of English ploughs to a certain extent, and make it dependent upon a general improvement of the condition of the agricultural classes. But these obstacles are to a great extent non-existent, and vanish before the common sense of a practical farmer, acquainted with the principles of modern agriculture, and who is not at a loss to adopt such alterations as the peculiar agricultural condition of this country necessitates. We have received confirmation of this from various sources; among others, a gentleman, whose professional status adds considerable weight to his statement, writes from Bangalore:—

"The difficulties suggested in Mr. Buck's paper, as regards natives using ploughs of light English pattern, have no practical existence. I carefully watched natives ploughing at Mr. Harman's farm, and they seemed to have no more difficulty than in employing their own implements. The cattle understand all about it in a short time; they need not be exceptionally powerful, and all that is wanted to start with is a brief training for the cattle and the man who holds the plough. A European contractor and ironsmith here has started the making of iron ploughs, the large size costing Rs. 45, and the small size Rs. 35. The repairs are quite within the competence of native blacksmiths, as indeed is also the making up of the plough. Regarding the general introduction of English ploughs among natives, a Settlement Officer writes from the N.-W. P:

"I tried a light English plough last rains, and the result was very satisfactory, but the plough required four picked bullocks, no four ordinary bullocks could work it. English ploughs, therefore, even if the result (at harvest) is entirely satisfactory, necessitate as a preliminary—better cattle, and better cattle will only come, with slowly returning prosperity. And prosperity in its turn depends partly on seasons, and partly on a thoroughly efficient administration, reaching to, and protecting the actual cultivator, who, when he is reached, is a not very industrious, improvident, and when he has a chance, extravagant member of the community.

The following is Mr. Benson's letter:—

"I had recently an opportunity of reading a note by the Director of Agriculture, N.-W. P., on Colonel Corbett's *Climate and Resources of Upper India*, and some of the statements made regarding agricultural matters are so surprising, that I am led to write and deny several of them. In referring to "deep cultivation," whilst he appreciates the value of of it, as a "prophylactic" against drought, and as a means of bringing a fresh portion of soil within the reach of the roots of our crops, he raises five objections to the general use of the English, or of improved ploughs, four of which are, I believe, totally void of foundation. The disinclination of cultivators to the use of a new implement, is the natural outcome of the particular acuteness of the Hindu ryot and his fondness for the ancestral crooked sticks of barbarism. This could easily be overcome by granting bonuses to all who use improved implements and as I can show that such a practice is more economical than the use of the native plough, the use of the latter implement might be taxed. Before I refer to the other suggested objections, I would ask why Mr. Buck believes that "the native's verdict will be surest?" Perhaps because he (the native) is capable of appreciating the advantages of agricultural practices carried on close to him, with manifest benefit to the coffee-planter. Or perhaps because he will not plant trees, asserting that it is useless to do so, as they will only "grow of themselves,"

Inaptitude of English ploughs.—This is Mr. Buck's second objection, and one which I distinctly deny. It is true that perhaps some slight modifications of the ploughs used and made at home, are required for Indian use, but none of the modern English ploughs, except the largest are from their make unsuitable to Indian conditions; and, whatever may be meant by "furrow-scored hills," I am perfectly certain that no more efficient implement exists for the preparation of the surface of the land, with the aid of the harrow, &c., for irrigating purposes. I speak from considerable personal experience in working English implements for arable culture in India, and I think that perhaps Mr. Buck's informants were not capable of managing the implements put in their hands properly. The supposed necessity, for twisting the tails of the plough bullocks is, though *seemingly valid, perfectly absurd.* I have had ten or twelve English ploughs at work at a time, and many of the men threw furrows as straight, as you will see in England on an ordinary farm; and I have a man, thoroughly trained of course, who recently with a pair of cattle which had not worked in the plough more than a fortnight, ridged up a field on the Northumbrian turnip system (called Login's Egyptian Cotton System in Upper India, I believe), 250 yards long, as straight as the best ploughman in England would do it. In every case my coolies drive their cattle with the ordinary rein attached to the nose-rope.

Weakness of Cattle.—This objection has more foundation perhaps than any other, but it is only imaginary, I do not mean that with the present means at our disposal, we can easily plough deep (7·9 inches) with a single pair of cattle, but is there is any reason why either the sub-soiler should not be used, or that 2, 4, or 6 bullocks should not be yoked to one plough? One good sub-soil ploughing, with two pairs of cattle, would effect an improvement on the soil,—which no number of ordinary native ploughings ever will—inverting, stirring deeply, and mixing it, which three operations the native implement is incapable of performing. Mr. Buck is no doubt right in saying that the country cattle want more and better food; also, I think, he should add more care.

Expense of the ploughs.—This is seemingly at first sight an objection which cannot be got over, but it is perfectly certain that it would be far better economy for a ryot to invest Rs. 150 in a good substantial English plough (fairly efficient American ploughs can be imported for Rs. 17) and the good bullocks necessary to work it than in the three or four ordinary ploughs and yokes of oxen which are required to prepare the area of land which one English plough can. I give below an estimate shewing the comparative cost of starting and maintaining either system:—

Cost of maintaining an English Plough for one year.

Price of a good iron plough, country made ...	30	0	0	Rs.
Ditto a pair of good cattle	120	0	0	
				150
Wages of one driver, at Rs. 6 per mensem ...	72	0	0	
Cost of feeding, shoeing, &c.	145	0	0	
Repairs to plough	5	8	0	
Interest at 5 per cent. on Rs. 150	7	8	0	
Deterioration at 10 per cent. on Rs. 150 ...	15	0	0	
				245
Total cost ...				395
Deduct value of cattle and plough at the end of the year ...				135
Net cost ...				260

Cost of maintaining four native ploughs for one year.

Price of four native ploughs	6	0	0	
Ditto four pairs of cattle, at Rs. 35	140	0	0	
				146
Wages of four drivers, at Rs. 5 per mensem each ...	240	0	0	
Cost of feeding, shoeing, &c., four pair of cattle ...	440	0	0	
Interest at 5 per cent. on Rs. 146	7	5	0	
Depreciation at 10 per cent. on Rs. 140 ...	14	0	0	
Repairs to ploughs and contingencies ...	2	11	0	
				704
Total cost ...				850
Deduct value of cattle, &c. at end of year				130
Net cost ...				720

I do not pretend that the estimate is perfectly accurate, but I know that it is not an excessive one on the whole. I have supposed that in either case the cattle were fed and treated well. The contrast is too great to need comment, yet it only shows a part of the superiority of the English plough. Mr. Buck will himself acknowledge that land once deeply cultivated does not lose the effects of that operation for several seasons.

Difficulty of keeping them in order.—Wherever an ordinary blacksmith can be obtained, there can be an English plough, with a little trouble in teaching the smith at first, be kept in perfect repair. What a *mistrie* may be, I do not know; but, supposing it to be a smith, I know from experience that the native can turn out very creditable ploughs with his own tools, and without any external aid. Castings of course must be avoided in the construction of Indian ploughs; but they are unnecessary; and with a full-sized model before him, the native smith can make almost any common English agricultural implement, such as ploughs, harrows, &c. Profits may conquer prejudices, but the time this takes with fairness is manifest all over the world. Pressure will conquer prejudices, and this the Government of India can apply, being as they are (see Sir John Strachey's Budget Speech) landlords of the soil, and therefore responsible for the condition of things existing on their estates."

IMPROVEMENT OF AGRICULTURE.

In the last number of the Agricultural and Horticultural Society's *Journal*, there is an important paper by Major-General C. L. Showers, which discusses the causes of Indian Famines. If the famines which are now of such frequency and severity were due to drought, pure and simple; if all we had to consider in seeking to prevent them were the one question of supplying water to the parched soil, the problem before the country would be a comparatively simple one. Irrigation works of different kinds suitable to different localities would have to be pushed on with peculiar vigour, even if other important works had to be temporarily neglected; engineering difficulties would come in the way, but they would have to be overcome somehow; great schemes might prove failures—we should have to begin again; much more than Sir Arthur Cotton's 30 millions might be required, but if irrigation were the one sure and sufficient remedy for famines, the millions would have to be found; for, if there be one point on which every Indian authority and every English statesman are agreed, it is that by the result of our contest with famine, our fitness to rule this country is about to be tested. Unfortunately it is too clear that the remedy for famine must be something far more complex than irrigation.

We do not underrate the utility of irrigation. It is undoubtedly one of the means, and an important one, that must be used; but it is not only insufficient of itself, but, under conditions that exist in many parts of India, there is some reason to believe that irrigation alone is ultimately mischievous. We can force up a crop once and several times by irrigation but in so doing we may be only hastening on the process, already, there is reason to fear, too for advanced in this country, of impoverishing the soil. It is this question of the exhaustion of the soil which is chiefly treated of by Major-General Showers. We have frequently written upon the subject, and must content ourselves at present with drawing earnest attention to General Showers' paper, which we believe is also published in pamphlet form. The broad lesson which it ought to teach is that, in any enquiry into the causes and remedies of Indian famines, an important, if not the chief, place must be given to the question of how to improve the agriculture of the country. We have already, in noticing the Secretary of State's despatch on the Famine Commission, remarked that this question, which the Marquis of Salisbury almost overlooks, should receive the most earnest attention of the Commission. Railways we must have, and have quickly, for the real cure of famine will operate slowly; and when famine is actually with us, the urgent need is for ample means of distributing grain, such as railways can best provide. Irrigation, too, we must have, wherever irrigation can be trusted to counteract the effect of a season's drought; for with all our remedies, we cannot abolish drought. But railways and irrigation will only enable us to distribute the better, and consume the more advantageously, the produce of the country; while in the meantime there is great reason to believe, we might say there is distinct proof, that the producing powers of the country are being gradually exhausted. If, therefore, in governing India, we have any thought for the future, if it is not our intention to suck the resources of the country dry, and then to leave it to recover fertility in fallowness, and be manured by the blood of battle fields, we must do something more than build railways and dig canals. We must improve the agriculture of the country. General Showers quotes Columella as follows: "No one gifted with common sense will ever permit himself to be persuaded that our earth has grown old as man grows old. The sterility of our fields is to be imputed to our own doings, because we hand over the cultivation of them to the unreasoning management of ignorant and unskilful slaves." We would fain hope that the State is awakening to a sense of its duty as landlord of the soil, and not its duty only, but the absolute necessity that is laid upon it, if it is to continue to govern India beneficently, of giving its most earnest attention to this question of the improvement of agriculture. The task of teaching an ignorant and conservative people must be very difficult and painfully slow; but it cannot be impossible. It is the business of our statesmen to find out how it is to be done. We have often expressed opinions on the subject, and shall do so again as occasion prompts, but the task is laid upon Government, and no one can lift it from its shoulders. In the meantime we hope General Showers' pamphlet will at least serve the purpose of calling earnest attention to such questions as the necessity for better ploughing, for sub-soil drainage, and the necessity of manuring the soil. In these peaceful days, we go on taking crop after crop, year after year, from the soil, while we return to it nothing. The only rest that the harassed earth can receive is obtained in the season of drought, when cultivation becomes impossible; and the benefit it obtains from the fallowness of drought is, we should think, exceedingly small.

THE AGRICULTURAL CONDITION OF COIMBATORE.

MR. WEDDERBURN, the Collector, has sent to the Madras Board of Revenue some remarks on the chief points which Mr. Robertson in his report on the agricultural state of the Coimbatore district, advances against the revenue system.

Regarding the deterioration of the uplands of Coimbatore—a district which has always had the reputation of sterility—Mr. Wedderburn states that it has a most inadequate rainfall, and that the upland soils are very light, and the rain-wash of course partially denudes them to the benefit of lower lying lands which are highly cultivated and improved by wells. This natural alteration is beyond control. The amount of manure at the ryots' command does not admit of these uplands being manured.

Mr. Robertson visited the district after the harvest of a bad year during the dry months; and Mr. Wedderburn submits that he had visited the district under more favorable circumstances, after a favorable monsoon, he would have found luxuriant crops and ample pasture.

As regards the waste of water by ryots helping themselves to more than they require for rice cultivation, there is no possibility of preventing the practice, which is common to all India, unless the water be sold by measure as it is in Lombardy canals; much corruption, however, would attend this mode of collecting a water assessment. Moreover, there is an apparent but no real loss, as the water drains off to lower lands, and finally into the rivers, whence it is conducted to other districts. Much improvement has taken place in this district, by the construction of irrigation sluices in the large irrigation channels, instead of open cuts as was formerly the case. But even when we have in some degree controlled the expenditure of water, by these masonry sluices, we find them tampered with, and injured no doubt, in order to obtain an unrestricted supply. Mr. Wedderburn continues:

"With regard to the diminished rainfall, it is undoubted that there has been within my own recollection and observation in the last thirty years a marked decrease of scrub jungle and an increase of cultivation of such land, notably in the vicinity of Pollachy; but this decrease can in no way have affected the south-west monsoon rain, and useful crops have replaced unproductive jungle. Even when this scrub jungle existed, worse failures of rain took place in the early part of the century, and the failure of rain last year equally affected forest, lands in North Coimbatore hill forests where no denudation had taken place. As an example that the well known deficient rainfall is the chief obstacle to agricultural success in this district, I would advert to the recommendation by Mr. J. C. Wroughton, Collector, in 1845, of a tract of land lying near the Palghaut gap for cotton cultivation, the sole reason for which was that it obtained the advantage of both monsoons.

I have several acres of Bourbon cotton, which during the past two years have scarcely produced any return, and now, after the good rains of this monsoon, have attained great development and promise a large crop.

The valuable timber growing on the hills is rigidly preserved and, so far as the small funds at disposal allow, village plantations of fruit bearing and shade-giving trees have been constantly promoted I am of opinion that one of my predecessors, in his eagerness to clear unhealthy parts of jungle and to promote cultivation, has rather too much encouraged cultivation at the expense of scrub jungle at the base of the Anamallays and Palghaut range, but that has long been put a stop to, and no land whatever in the vicinity of a jungle, even if it had been formerly cultivated and allowed to relapse into scrub, is given out for cultivation without the opinion of the Forest Department being sought.

So far from there being any retrogression in progress I can confidently affirm that improvement, if slow, has been continuous; that Mr Robertson, by visiting the district when all the crops were mostly off the ground and when a deficient monsoon had made them also very light, was not in a position to form a right judgment.

He remarks on some grass land of which if you scraped an acre it would not fill a wheel barrow; on such lands after a good monsoon, the grass is knee-deep in excellent pasture.

Almost the only useful novel implement suitable for agricultural improvement for this district, which I selected from the Madras Farm, is the Improved Water Lift. I have had twenty of these put up in all parts of the district, and some private parties have followed the example. The benefit of an Improved Water Lift is, that half the number of cattle are employed, and consequently there is more fodder to spare and the cattle are better fed. Those in the Government plantations at Coimbatore are quite capable of drawing the English plough, of which I have two constantly at work, and the bullocks of the Municipality, fed on scarce anything but green fodder, cannot be surpassed anywhere in condition and efficiency in this Presidency.

The benefit of using the town manure has been practically shown, and applications began to be made for it when the neighbouring farmers saw an increase of 50 per cent. of grain accruing by such use. The utilization of such neglected manure must of necessity be slow, but so are all improvements in this country.

The wonderful state in which this district is left after a year's almost complete scarcity added to a deficient harvest of the preceding year shows that there has been an improvement in the status of the cultivators; notwithstanding such adversity leading in many cases to the sale of personal property and the incurring of debt, the land from my personal observation and from the reports of my official subordinates is now under most promising crops, and only a small proportion of the ryot-proprietors came on the relief works, though in close proximity to their villages. This is quite incompatible with the hypothesis of a deteriorated soil and a ruined tenantry.

In fact the numerous wells to be found all over the district and their annual extension point to the increasing wealth and to the investment of it in the improvement of cultivation.

THE BLIGHT IN THE MADRAS PRESIDENCY.

MR. M. R. WELD, Acting Special Assistant Collector to the Collector of the Chingleput district, in a letter dated Tripasore, 5th January, says :—" I have the honor to report that the rice crops about Trivellore are being spoiled by a blight known as the 'Uru Pucchi.' It is said to be a minute insect which burrows its way down the stalk and destroys the life of the plant. Affected plants when examined closely show brown withered stripes along the leaves, and a field of such crop has a pale color. I am told by several ryots that the crops will not yield one-third of a full harvest. This morning I heard of the appearance of locusts in the village of Christian Kandigai, near Kadambathur Railway Station. It seems they attacked this neighbourhood last in the scarcity of 1866. The people say they are utterly destroying the crops."

The Government communicated the above to the Superintendent of Government Farms, who was instructed at once to go the place and examine and report upon the blight and, the injury to the plants.

Mr. Weekes, Divisional Officer, Pulivendla, in a letter dated Thoomalapalli, 6th January, says :—

" I have noticed both in August on the red cholum, and now on the yellow cholum, in the Pulivendla Taluq, the very extensive prevalence of a blight which seems to grow and ripen in horn-shaped deconical pods in the place of the grains, and when ripe sheds a black powder, like the 'sweet' sometimes seen on wheat.

" I observed a similar blight in Bengal on rice, and sent some specimens to Dr. King, the Superintendent of H. M. Botanical Garden, Howrah, who kindly obtained the opinion of Dr. Cunningham on it. That gentleman, who has made blight and similar growths a special study, after describing the nature of the blight, gave it as his opinion, that the dust or " sweet " if left adhering to any seed grain will undoubtedly reproduce the blight on the crops raised from such seed, and recommended that seed grain, tainted or suspected to be tainted with this dust, which I believe is the seed of the blight parasite, should be passed through a flame to destroy the vitality of the blight.

" This is a very important fact, and it seems to me that it ought to be widely made known to the cultivators, who should be warned to pay particular attention to the goodness and clearness of their cholum seed, and on no account to sow any that is infected with the dust of blight, without previously passing it through a flame.

" It occurs to me that the excessive prevalence of this blight, this last season, may be, and possibly is, owing to the ryots having been obliged to use little discretion in their choice of seed, and having even selected smutty grain in preference, as less agreeable for food, and in their opinion quite as serviceable for seed as cleaner grain. The loss caused by the blight is enormous, and I have no doubt that if the ryots were clearly informed of the risk of prepetuating it and really believed the facts when told them, they would be ready enough to guard against it. I would suggest, then, that the cultivators throughout this and other districts should be warned of the nature of this blight.

" I have sent specimens of the blight to Dr. King, Superintendent of H. M. Botanical Garden, Howrah, but it is so like the blight I observed on rice in Bengal, that I have no doubt that the black dust or " sweet" will reproduce the blight. When there is, as now, such a quantity of the blight about, there is great danger of its infecting the grain kept for seed, and I would advise all the bad parts of infected ears being burned on the fields as soon as possible, the good grains, if separated, being kept for food, but on no account for seed.'

Mr. J. W. Johnston, Special Deputy Collector to the Acting Collector, submitted the foregoing for the information of Government :—

" I observed a day or two ago, the same kind of blight as that mentioned by Mr. Weekes. I was told that it was not excessively prevalent. I have often seen it before. The measures suggested by Mr. Weekes would be desirable, but it is not at all likely that the people will attend to them. An attempt to bring them to the notice of the ryots will be made, as soon as the Vernacular name of this particular class of blight has been ascertained. The seed used for cultivating purposes is always picked and the inferior grain is eaten. The occurrence of blight in this country appears to be rather attributable to atmospheric conditions than to dissemination by infected seed."

These papers were referred to the Superintendent of the Government Farm at Sydapett for an expression of his opinion as to the best method of arresting the development of, and destroying, the blight germs.

Mr. Robertson writes on the subject to the Board of Revenue :—

" From Mr. Weeks' description, I am of opinion that the disease in the cholum referred to is 'ergot.' I have, however, applied direct to the Collector of Cuddapah for specimens of the diseased heads of cholum. Ergoted grain produces most serious results when used as food by man; it is also highly injurious, though in a less degree, when used as food by cattle, sheep, &c. In Great Britain " ergot" is met with chiefly on the rye plant, but in other countries it attacks nearly all the cereals; indeed, a few plants of other orders as well.

" There has been much controversy regarding the origin of the disease, but it appears to be generally admitted that it is caused by the spores of a parasitic fungus which, while the plant is blooming, find access to the fructifying organs and infect them. It has been proved that ergoted grain is produced from seed affected by " ergot." It is said that even if the spores of the fungus are scattered on the ground where a cereal crop is growing that this is sufficient to produce the disease. Unfavorable weather and bad tillage favor the development of the disease.

" There are several chemical dressings which are used by European farmers for protecting seed, supposed to be infected by the spores of parasitic fungi. Amongst these, sulphate of copper is the most generally used. But it would be premature to discuss this matter further in the absence of any definite information as to the exact nature of the disease under notice. I would, however, suggest that the attention of the Sanitary Commissioner should at once be directed to the matter, for the use of ergoted grain in the food of man is attended with serious results, causing, it is said, gangrene of the extremities and, in aggravated cases, destroying joint after joint until the patient sinks under his sufferings."

TWENTY YEARS' PROGRESS IN INDIA.

THE official account of the products of India which were shown at the Philadelphia Centennial Exhibition of 1876 is accompanied by a report prepared by Dr. J. Forbes Watson, of the India Office, on the progress of India in the last 20 years—namely from 1858, when the Government was transferred from the East India Company to the British Crown, to the year 1877. In those 20 years, he says, India has undergone a profound transformation. Two causes have mainly contributed to bring about this result—the gradual progress of education, and the extraordinary development of means of communication. The *Times* has an article on the subject, from which we gather that the expenditure on education, as far as the Government is concerned, has increased four-fold, and now exceeds a million sterling in the year, and the number of pupils has increased from about 200,000 in 1857, to about 1,700,000, and is rapidly increasing, Small as this number may seem, being below 1 per cent. of the population, it shows extraordinary progress, and proves that education is beginning to affect the masses. At any rate, it compares favourably with the number in other semi-civilized countries; the school attendance in Russia is about the same. The progress of education in India is also shown by the increasing number of graduates of the Universities of the three presidencies and the large number of pupils in the special engineering, art, and medical schools; and equally striking is the rapid growth of the native press and literature. But the results of the progress of education are at present valuable chiefly as the *promise of a better future*, when the present generation shall have grown up. The changes wrought by improved means of communication have been, on the other hand, almost instantaneous and have already transformed the whole face of the country. The length of railways open in 1857 was 274 miles ; in 1876 it had become 6,497 miles. The passengers carried in 1857 were 1,825,000; there were 26,779,000 in 1875. The miles of telegraphs increased from 4,162 miles to 16,649 miles, the letters and packets conveyed by post from less than 29 millions to more than 116 millions in the year. The opening of the Süez Canal in 1869 also marks a turning point in the trade of India and the East generally. The revenue of India has advanced from £31,691,000 in 1857 to £55,422,000, Imperial and provincial in 1877; the expenditure from £31,609,000 to (estimated) £61,382,000 in 1877. The excess of expenditure over income in 1877 is due partly to the famine and partly to the outlay on remunerative public works. Adding together the cost of public works, of education, and of surveys, and other scientific operations, we find about £10,000,000 now yearly spent by the Government of India for the permanent improvement of the country and its people. The trade and shipping returns show a vast increase in wealth and prosperity. The tonnage entered and cleared in the foreign and coasting trade was 4,549,000 tons in 1875 and rose to 9,887,000 tons in 1877. The value of the imports was £28,608,000 in 1857, and £48,697,000 in 1877 ; of the exports £26,591,000 and £62,975 000 respectively. These figures include treasure as well as merchandise. The imports of treasure amounted in the 20 years, 1858-77 to £266,582,677. but the exports of treasure to only £28,891,567 showing an increase in the precious metals to the amount of nearly £239,000,000, about £1 for every head of population in the whole of British and Native India. The imports of merchandise have risen from £14,000,000 to £37,000,000 in the 20 years, an increase of 163 per per cent. ; the exports of Indian produce and manufactures from somewhat over £25,000,000 to £25,000,000 to £59,000,000, an increase of 133 per cent , the total of imports and exports of merchandise showing an increase of 140 per cent.

While the trade of India has thus increased in volume it has completely changed in character. Many of the old staple articles of Indian trade continue stationary, or are even declining. This is the case with the silk and silk manufactures, formerly such an important item in Indian exports : in fact, in the current year there have actually been more silk and silk manufactures imported into India than exported from it. A like decrease may be observed in the export of Cashmere shawls and other woollen manufactures and also in saltpetre, another characteristic Indian produce. The export of sugar also has largely decreased, India being beaten by Mauritius and other plantation colonies in international competition ; but her internal consumption of sugar is enormous, and its cultivation still holds the first rank in Indian agriculture, as the most valuable crop, the various grain crops alone excepted The best ground is devoted to it, and the total value of sugar and molasses annually produced in India is probably not less than about £20,000,000, or considerably more than the value of the cotton crop. On the other hand a gigantic trade has sprung up in articles which were formerly of very small importance. They belong mainly to three classes. There is, *first*, the bulk agricultural produce, which in consequence of the improved means of communication, can now be thrown upon the markets of Europe. The trade in grains and seeds of all kinds sprang up about the time of the Crimean war, in consequence of the closing of the Russian ports, from which the main supply had been deen derived. The total trade in grains and seeds increased in value from £3,885,000 in 1857 to £13,569,000 in 1877, or about 274 per cent., and now constitutes 23 per cent. of the entire exports instead of the 16 per cent. of 1857. The most extraordinary development is shown in the trade in Wheat, now approaching two millions sterling. The export of hides and skins also shows considerable progress, and the export of opium has risen from £7,057,000 in 1857 to £ 12,405,000 in 1877, but this last high figure is due not so much to the prime cost of the article as to the duties placed upon it. A second group of articles comprises raw textiles, the vegetable and animal fibres which now form the most important item in Indian exports—namely, cotton, jute, and wool. The exports of these have grown in value from £2,027,000 in 1857 to £15,460,000 in 1877. Of this last sum, raw cotton accounts for nearly 12 millions. In 1865 the Indian exports of cotton shot up to above 37 millions sterling, and, notwithstanding the fall in value after the close of the American civil war, the quantity has been very fairly maintained, and cotton holds its place as one of the most important articles of Indian trade. The trade in jute has been entirely created within the last 30 years and has a great future before it. The development of the wool trade is also comparatively recent. The third group of the new growth of Indian export trade—namely, exotic products recently acclimatised in India by means of European capital and enterprise is perhaps the most interesting. The exports of tea shew an increase from £121,000, in 1857 to £2,607,000 in 1877, and of coffee from £133,000 to £ 1,346,000. The production of tea in India in the past year is equal to the total quantity consumed in the United Kingdom so late as in the year 1840. Another exotic, the cinchona, promises to become important. Introduced by Mr. Clements Markham so late as 1861, there are now nearly three millions of trees in the plantations in India, and the Government sales of bark amounted to £29,000,000 in the past year. Several other Indian products, such as tobacco and India-rubber, also begin to attract attention, and the trade may attain very considerable dimensions. The returns of imports also during the last 20 years should not fail to attract attention, as showing how greatly the consuming power of India has increased. The principal articles are cottons (the cotton manufactures reaching nearly 16 millions of sterling in the last year), woollens, metals, and metal work, machinery and mill work, railway materials, beer, wine, and spirits, the increase ranging from 160 to 533 per cent. In respect to several of these articles considerable progress has been made in establishing manufactures for their indigenous supply. A large and rapidly increasing number of cotton mills has been established in India, and successful attempts have been recently made to manufacture iron on the European method. The output of coal in the Indian coal mines has considerably increased of late, and already supplies some of the Indian railways with the whole of the fuel required. The total area over which coal rocks may be presumed to extend is above 35,000 square miles. Dr Forbes Watson observes that the statements thus made show that India, known usually as the country of caste and immutable tradition, shows herself possessed, under her present rule, of a remarkable power of expansion as regards trade and commercial development. It must also be remembered that the above figures refer to the seaborne trade, and that of late years the land trade with Central Asia and Thibet has been acquiring some importance. If once the communication with these countries and with China is improved, we may expect a considerable increase of trade in those directions. We may just add that British India comprises an area of nearly 100,000 square miles and contain about 240 millions of inhabitants. The greater part of the country —three-fifths of the area and nearly four-fifths of the population— is placed directly under British administration ; the remaining portion continues under the rule of different Native Princes, who, however, still acknowledge the supremacy of the British Crown.

BAMBOO AS PAPER STOCK.

THE question of the suitability of the Bamboo, as a raw material, for the manufacture of paper, is now receiving thorough ventilation in all parts of the world, and the great demand which exists, by paper manufacturers, for abundant and cheap materials for their manufacture, is raising this question to one of [illegible] importance.

We have already stated that, as far as India is concerned, such experiments as have been made, go to prove that a systematic utilisation of the young Bamboo-shoots for paper stock would, financially, be probably a failure, though it seems beyond doubt that a very good paper can be manufactured from it.

Dr. Hooker writing on this subject in his last annual report says :

> 'The Bamboo appears to be only really available for paper-making when in a young state. The experience, however, of all persons acquainted with tropical vegetation establishes conclusively that cutting the young stems is the most effective method of destroying the plants. The only possible plan of obtaining paper-material from this source is to cultivate it in the same manner as is pursued for the sugar-cane, replanting after cutting the crop. Whether under these conditions, and considering the time that would be required

before the plants would be mature, the material would allow the paper-maker a profit, is extremely doubtful. Added to this, the large amount of water in the young stems would render it necessary to crush and press them in the country where they were grown, and send the 'stock' only to this country."

These remarks have elicited a letter from Mr. Robert Thomson, the Government Botanist, who has so successfully established cinchona cultivation at St. Andrew's in the island of Jamaica. The letter is published in the *Journal of the Society of Arts* by Mr. Routledge, who in the way of preface states:

"It is well known that when the bamboo reaches full maturity, ranging from 40 to 60 years, it flowers, seeds, and dies; thus it occurs that whole districts in India, where bamboo is in universal use, and almost indispensable for building and other purposes, are deprived of this valuable material, or have to procure it at enhanced cost from other districts, as years elapse before productive clumps available for use are reproduced from seedlings. It is very desirable, therefore, that it should be known, on the authority of so reliable a practical botanist as Mr. Thomson that not only can the bamboos be rapidly propagated by planting, but that by judicious cropping the continuous and reliable supply of such an abundant and valuable paper-making material can be assured."

The following is Mr. Thomson's letter:

Cinchona Plantations, Jamaica,
6th November, 1877.

Dear Sir Joseph,—I have thought of writing to you for some time on the subject of your remarks in your last annual report on Kew-gardens on bamboo as a material for paper-making. I hope you will excuse the liberty I now take in submitting the views I entertain on this subject. I have taken much interest in this matter, and have been in communication for some time with the largest firm of paper exporters in America with the object of establishing the export of the raw material from here on a large scale. I have also from time to time, in my reports to the Government, referred to bamboo as being one of the most important paper-making materials. And I may further mention that both the *European Mail* and the *Planter's Gazette* have recently noted the encouraging prospects that exist in Jamaica of establishing a large export trade in bamboo.

Cutting the bamboo stems *en masse*, as you have stated, would undoubtedly destroy the plants, but, with great de[illegible], I would remark that this destruction of the plants can be effectually prevented [illegible] the adoption of a different [illegible] instead of cutting all the stems simultaneously, a [illegible] pro[illegible] mature stems [illegible] retained, and this need only be [illegible] sufficient [illegible] in the vigorous action [illegible] for the preservation of the [illegible] of the roots [illegible] required, they may be lopped so as to [illegible] and foliage near the ground. Another point [illegible] manner in which the young, succulent stems are cut [illegible] should be cut—that is, the crop for making paper—not [illegible] the ground [illegible] few nodes above the ground should be left. This [illegible] the [illegible] of branches and foliage from some [illegible] the [illegible]

The con[illegible] supply of the bamboo [illegible] plan a[illegible] gated to a very considerable quantity each year [illegible] be [illegible] a bamboo plantation may be kept up and [illegible]

I have seen three tons of full-grown [illegible] bamb[illegible] [illegible] ing only a few square yards. This would be at [illegible] per acre. By the system of cropping which I propose [illegible] succulent stem, in that condition in which a penknife is easily p[illegible], when dried averages only about three pounds in weight. As [illegible] thousands of these are obtainable per acre annually, I feel sure that [illegible] ten tons of paper stock could be procured from each acre annually [illegible] even at the half of this, the cultivation would prove highly remunerative.

The system of reserving a due [illegible] of growing stems, by which [illegible] would be constantly obtainable is so obviously advantageous that I think [illegible] would entirely supersede the plan proposed by you, [illegible] growing bamboo like the sugarcane, and to replant after cutting [illegible] bamboo cuttings, though they root immediately, require to be [illegible] a long time, certainly over two years, before they produce large and [illegible] stems suitable for paper-making.

It is a pity that some method could not be devised for utilising the ripe bamboo [illegible] in paper manufacture. Some years ago hundreds of tons of the ripe stems were exported from here to America, which stems, I have been informed on reliable authority, were made into paper. This trade was brought to a close owing to some difficulties in the monetary affairs of the merchants in New York, to whom the bamboo was consigned. An almost incredible quantity of ripe bamboo is procurable from each acre of land, and I find that the ripe bamboo is used in China for paper manufacture. In a most interesting "Catalogue of the Chinese Imperial Maritime Customs' collection of products at the Philadelphia Exhibition, published by the authority of the Inspector-General of Chinese Maritime Customs, the following account is given of the process of treating the bamboo stems.—'The method of preparation from [illegible] bamboo is as follows The bamboo is stript of its leaves and split into lengths of [illegible] four feet, which are packed in bundles and placed in large water [illegible], each layer of bamboo is then covered with a layer of l[illegible], water is poured on till the topmost layer is covered. After remaining in this condition three or four months, the bamboo becomes quite rotte[illegible] is [illegible] into pulp in a mortar, cleansed and mix[illegible] liquid [illegible] poured in quantities sufficient for the [illegible] requ[illegible] upon square sieve-like moulds. These [illegible] (a workman can make six in a minute) are allowed [illegible] taken from the mould and placed against a moderately-[illegible] ally exposed to the sun to dry. The best quality is made from the [illegible] of the bamboo, with alum added to the infusion; the second from the bamboo itself, though a higher grade of this quality is attained by the previous removal of the green portion.

I would add that the prices of paper made from the bamboo in China range from 3 dollars 61 cents to 21 dollars per *picul* [illegible] lbs.)

ROBT. THOMSON.

To Sir Joseph Hooker, F.R.S.,
Director, Royal Botanical Gardens,
Kew.

It has been long known, that the bamboo is employed by the Chinese and Japanese for paper-making purposes; but it is only since the discovery of Mr. Routledge's new process of treatment, that it has been found possible in Europe to produce good paper from bamboo fibre at a moderate cost.

We have referred, in a previous issue, to the bamboo tracts of British Burmah; but in the Madras Presidency there are likewise large areas of land on which the bamboo grows wild; but these tracts of country are generally too distant from the coast to admit of the canes being transported and shipped at a moderate cost; while, as these bamboo jungles are frequently very feverish, there is but little probability that a factory for preparing paper-stock could be established on the spot and worked with economy.

From Mr. Robertson's last report we observe that the bamboo (*Bamboosa Arundanacea*) which is found growing singly and in clumps, in so many places in the eastern part of the Madras Presidency, is not suited for cultivation in the way Mr. Routledge advocates. It is too bushy in growth, has too many lateral branches, and is armed with long sharp formidable spines. Mr. Robertson forwarded to Mr. Routledge, at his request, a bale of stems and branches of this bamboo, taken from a plant about five years' old, which was growing under ordinary conditions. Regarding these samples he writes:—

"The spines, I see clearly, are awkward to deal with, and if bamboo has to be cultivated at all near you, it would appear that, owing to these spines, and the bushy habit of the variety, another species should be selected in preference. The stems sent are wholly unsuited for my purpose. They are far too *woody*, whether from age, or whether from the nature of the plant, the dryness of the climate, or other reasons, I am unable to determine. I am more and more convinced that it is hopeless to grow bamboo for any purpose, that is, to get abundant crops of young succulent stems in the herbaceous stage without abundant and almost perennial moisture of soil with good drainage; and if this cannot be secured naturally it must be provided artificially by irrigation as, and when, required. But water the bamboo must have—not merely to promote rapid and prolific growth, but to ensure soft, silky, and delicate fibre. Hard, woody, silica-coated stems are unsuitable for paper-making or [illegible] purposes."

The canes sent to England were fair average specimens of those procurable near Madras. The *Bamboosa Arundanacea* is capable, of withstanding the effects of a long drought, from its slow growth; while, from that very reason, it produces hard canes, that are well suited for use in roofing huts and other similar purposes; but, these qualities are, in the estimation of the paper manufacturer so many defects in this bamboo, for, he requires a soft-wooded succulent stem.

STATISTICS OF AGRICULTURAL PRODUCE—MADRAS.

GRAIN IMPORTS.—The following statement shows the imports into all the Ports of the Madras Presidency from Ports beyond the Presidency from 1st May 1876 up to the week ending Wednesday 26th December 1877:—

	Rice.	Paddy.	Other Grains.	TOTAL.
	Tons.	Tons.	Tons.	Tons.
Ganjam	33	...	...	33
Vizagapatam	993	352	36	1 381
Godavery	744	107	53	904
Kistna	979	210	85	1,274
Nellore	9.761	1,363	27	11 151
South Arcot	8,888	2.767	62	11 717
Tanjore	37,700	46,065	5,145	88,910
Madura	5,660	19,234	223	25,117
Tinnevelly	66,720	6,245	6,818	79,783
South Canara	546	3	2,720	3,269
Malabar	126,062	45,380	57,113	228,555
Madras	429,943	20,625	87,438	538.006
TOTAL ...	688,029	142,351	159,720	990 100
Deduct export to places beyond the Presidency up to 30th November 1877	88,079	16 917	9,540	114 536
Net Imports	599,950	125 434	150,180	875 564

The countries whence these imports came are Bengal, which exported 730,195 tons, Bombay 73,554 tons, British Burmah 148,593 tons, other British Indian ports 14,344 tons, Foreign ports 23,414 tons—Total 990,100 tons.

SEEDS.—The progress of trade under this head is shown below. Gingelly seed, from which oil is extracted, constitutes the bulk of the trade:—

Years:		Quantity.	Value:
		Cwts.	Rs.
		612,598	16,77,941
1855-56	...	707,906	23,85 980
1856-57	...	1,238,853	29.59.560
1857-58	...	624,710	25,56,507
1858-59	...	356,272	14,81.558
1859-60	...	520,866	22,76 749
1860-61	...	668,772	27.91,666
1861-62	...	893,920	37,43,963
1862-63	...	627 312	22,64,306
1863-64	...	722,688	27,57,548
1864-65	...	592,281	22,68,837
1865 66	...	104,712	4,88,966
1866-67	...	639,261	34 33,040
1867 68	...	639 261	34,33,046
1868-69	...	1,066 796	50 66,706
1869-70	...	860,120	50,38,699
1870 71	...	...	49,36,500
1871-72	...	...	57,88 709
1872-73	...	...	39,98,400
1873 74	...	...	50,08,760
1874 75	...	...	53,87.173
1875-76	...	1,360,506	58,66,899
1876-77	...	904,791	49,06 413

The figures in column 2 for the years up to 1870-71 do not exhibit the exact quantities for the values given, but only those of the descriptions of seeds, for which weights were recorded in the trade returns. As, however, the kind of seeds for which quantities were not recorded were generally insignificant, their omission will not materially affect the comparison. The trade has, on the whole, increased in value from nearly 17 lakhs of rupees to nearly 50 lakhs, but the quantities exhibit considerable fluctuations. Up to the passing of Act XVI of 1875 an export duty of 3 per cent. was levied on produce of this description, and its abolition led to a considerable increase in the exports in 1875-76.

INDIGO.—The trade in this article is liable to very great fluctuations, being mainly dependent on the quality of the produce, which is materially affected by the nature of the season. The exports for the last twenty-two years are shown below.

Years.		Quantity	Value.
		lbs	Rs.
1855 56	...	2 899 627	43,14.286
1856 57	...	2,846 838	47,24,631
1857-58	...	2,088.682	38,59,[illegible]
1858 59	...	1.984,773	35,78 679
1859 60	...	2 531 726	45,35,528
1860-61	...	1 589,612	28,11,882
1861-62	..	2,328,636	48 69,090
1862-63	...	2 433,168	51 67,790
1863 64	...	2,023 784	40 37,259
1864 65	...	1,530 508	33,35 915
1865 66	...	1 601 240	34 57,070
1866 67	...	658,336	14,21,717
1867 68	...	2 251.088	41,83,587
1868-69	...	2,663.920	61 03,555
1869 70	...	3,076,304	75 47,745
1870 71	...	3,883 572	85 31,908
1871-72	...	5,204 612	1 20,82,388
1872 73	...	2,985,206	69,31,400
1873-74	...	4,248,524	88,28,959
1874-75	...	2,791 852	57,15,508
1875-76	...	2,554 832	47,31,631
1876-77	...	3,127,432	56,07,120

The exports of 1876-77 show an increase of about 22 per cent. in quantity, and nearly 19 per cent. in value. Indigo cultivation is chiefly carried on in Cuddapah, South Arcot, Nellore, Kistna, and Kurnool districts, and the bulk of the exports are from Fort St. George.

EDITORIAL NOTES.

WE would draw the attention of our readers to an article on "Ashes as Manure" by Dr. Atwater published elsewhere. The article should be read in connection with the circular of the *Vegetable Ash Manure*, now manufactured in Calcutta, which was issued as a supplement to our last number.

IN our article on Deep Cultivation, in our issue of January, we referred to a rice crop, growing on a plot of the Bangalore Experimental Farm, which had been deeply cultivated. The crop was estimated by Mr. Harman as likely to be at the rate of 3,000lbs. of grain per acre. Considering that the season was an exceptionally dry one, and that the best soils of Piedmont and Carolina, under a European system of cultivation, rarely yield more, even with the aid of manure, than 2,500lbs. per acre, we considered Mr. Harman's estimate a very sanguine one, and doubted whether the yield would be quite so high. The rice crop referred to has now been harvested, and the yield has been, according to independent and reliable information, something enormous and almost incredible, exceeding by far the estimate. Our correspondent writes:—"I observe in your paper of the 1st January, a notice of the rice crop grown by Mr. Harman without any irrigation. There is no doubt about it, as I myself saw the field at least twice during growth. Towards ripening, the rice had a uniform waving appearance like a fine green wheat-field at home. I measured a chance stalk, which I found to be over 4 feet high. Mr. Harman told me the yield was at the rate of 4,300lbs. per acre. As far as I can judge, there is nothing, except want of due preparation of the land and sowing at the proper time to prevent rice being grown over very extensive areas without the aid of irrigation. In the Southern States of America, I have read that it has been found perfectly possible to grow rice upon high and dry arable land, but, that to do so, the system of cultivation must be thorough, so as to have the land in good order and quite clear of weeds. Rice is very sensitive to the presence of these. The use of irrigation water lessons the expense of growing rice by keeping the weeds down; for rice will spring in water, and weeds will not. I hardly like to go into all the conclusions with regard to India that may be drawn from these and other facts, but can see that immense changes are involved as they become recognised—*Toute revolution morale entraine cependant une revolution politique.* I saw this morning at Mr. Harman's farm a capital crop of maize just being grown under slight well-irrigation, and about 2 feet high at present. He has, say, three 10-feet diameter wells for two acres, and waters about once in six or eight days, so that the wells afford an ample supply of water. The English ploughed land retains the water it gets. Under the same circumstances, natives would water every day and be always running their wells dry."

Evidence is pouring in from all sides, bringing to prominent notice the satisfactory results of *deep cultivation* in this country; and it will be culpable negligence on part of our Government, if energetic measures are not taken to aid its introduction over the whole length and breadth of the Empire by all the powerful means at its disposal. It is time that the Department of Agriculture should devote its attention to something better than the compilation of incorrect and misleading statistics.

WE regret to learn, that there is great and growing distress in Kattyawar, and people are emigrating in large numbers, many of them finding their way to Bombay. Some three hundred persons—men, women, and children—are at present, says a Bombay contemporary, herded in a shed on the Port Trust property, and are maintained by contribution of dry grain from a few charitable people Others are wandering about the streets in a destitute condition. Th price of grain in Kattyawar is four times higher than it was i January 1874, and twice as high as it was even in January 1877 Several *talukas* are suffering severely from the scarcity. Th labouring classes cannot, even when they find work, earn sufficien to buy food at its present rate, and they are emigrating wholesale The cultivators find it very difficult to support their families an keep their plough cattle alive. Some of the Native Chiefs have don a great deal to mitigate the sufferings of their people, but as class the Kattyawar Chiefs have lost heavily by the partial failur of the crops last year, and they are not able to do all that is requir ed. Three millions is the estimated loss through the failure of th cotton crop alone.

THE scarcity of grass at Rajkot, has become so bad that the native cavalry regiment stationed there has been ordered to Deesa and the mountain train battery is to be sent to Ahmedabad.

WE have distressing accounts from Madras. At the meeting of the Executive Committee at Madras on the 4th February very gloomy accounts were received from some of the districts. At Bellary the Committee had found it necessary to continue the relief, though they had previously agreed to discontinue it, and accounts of great distress had been received from many of the *taluks*. There had been a total failure of crops in some of the villages of the Pulney *taluq*. and a partial failure in others. Even the paddy crops in some of the districts were showing symptoms of disease. The dry crops have suffered in many ways—by blight, insects, and untimely and excessive rains. Prices have not fallen, as they were expected to. In some parts they are even rising; whilst everywhere they are abnormally high. There is but a trifling importation of food-grain by sea, though some hopes are entertained of a change for the better. Up to the end of November the area of cultivation throughout the whole of the Madras Presidency was 2,750,000 acres below the average, which is 14,500,000 acres. Nor is there much chance, at this period, of an increase. The harvest of the dry crop is 60 per cent. of the whole, and is now, nearly over. The wet crop will no doubt be a good one, but it is believed that much of it is already in the hands of merchants and *sowcars*, whose interest it will be to starve the market. Under these circumstances much depends on the turn things may take at the end of this month and at the beginning of the next, when the wet crops are harvested. Unless prices fall then, Government fears that relief must be continued till the *kharif* is harvested; till August or September next—a terrible prospect!

"A PERFECT deluge of rain" fell in the North of the Punjab in the middle of last month, and, we regret to add, did considerable damage to the crops, especially to the sugarcane. The mountains surrounding the Peshawur Valley are, we are told, covered with snow to a far lower line than is usual in the winter. The latest reports from the North-West Provinces and Oudh are gloomy: "There has been a fresh fall of rain over a large portion of those Provinces and Oudh. Hail, damp, and blight have injured crops in some parts. Fine weather is required to secure the ripening harvest."

MATTERS appear to be very bad in the hills north of Dehrah. We read that many of the more respectable class of cultivators, who never left home to take service before are now wandering about in search of employment as coolies, &c.; and that, amongst a race formerly as conspicuous for their honesty as for their want of cleanliness, petty thefts are becoming by no means uncommon.

THE Behar paper reports that great damage has been done to the *rabi* crops in some of the villages near Patna by some unknown insects which resemble ants.

A CORRESPONDENT at Agra writes that the villagers are thronging into the city: "Wheat is sold 11 seers a rupee; gram not more than 12½. People in the villages live much on radishes, carrots, &c., &c. Some of them are again running to the sudder station, and the city is thronged with them. The well-to-do at first commenced giving alms, but now have ceased to do so, as these beggars, instead of being objects of compassion, have become a terror. They have commenced *looting* the *khonchawalas* and shops in broad daylight, even in the principal streets of the bazaar. The policemen, set to watch the *mokas*, could or would do nothing. I do not find fault with them alone, nor is the Government to be blamed; the authorities are doing what they can. Relief works have again commenced, and about 9,000 persons are working." Great distress is prevailing throughout the district.

PRIVATE accounts from Rohilkund are confirmed, unfortunately, rather than contradicted, by official reports. The failure of the *kharif*, on which the people for the most part live, is having a terrible effect; and six weeks must pass before the *rubbee*, such as it is, can be harvested. The price of wheat ranges from 10 to 11 seers the rupee; the limits for the same time, a year ago, being 19 and 20 seers. There is no grain left, they say, in the whole division; and though large quantities are brought in by the Oudh and Rohilkund Railway, the imported grain is bought up at the stations, and hardily ever gets farther. The people die of hunger; none but the well-off are safe. Some relief is given, the Government doubling private charity; but this is said to be insufficient; and a painful feeling is abroad that Government, resolute against a famine, has neglected its duty.

THE local authorities in Cashmere are to be partly thanked for the hopeful prospects there. They made the agriculturists turn out and dry the crops. The cause of the panic was a long spell of rainy weather; but it was found, after the crops had been gathered in, that there was no great need of alarm; and prices, which had risen, began to fall again. There will be a scarcity, but there is no reason to fear actual famine.

THE locusts, which since November have been troubling Madras, seem to have come from the north, perhaps from Bengal. They attacked the *ragi* and *bajri*, just as the young crops were appearing above the ground. The ryots tried the effect of night-fires, but the locusts objected to this kind of extermination.

AN exceptional dry season in the Madras Presidency, and eventually excessive rainfall at an unseasonable time of the year, seem to have brought out all sorts of pest and insects. We have heard during last month of nothing else from Madras but blight and locusts. Locusts in Tinnevelly, in Cuddapah and all adjoining districts. A missionary writing from Madura says:—"Yesterday the villagers called me to Mandapasalai to see the locusts. Thousands upon thousands had covered the ground—the houses and the walls—in some places so thick that there were 200 in a square foot; they had come from the south-west, and soon they came into our compound. We had a large field of cholum, eight inches to a foot high, but beautifully green. In two hours it looked as if it had been burnt with fire. From 10 o'clock yesterday they were slowly passing us, and this morning they are all about; the garden is full. They eat only the grass and the cholum or cumboo; they have cleaned the crops in their way. The people heard that they were coming, and night before last cut their grain so far as they could; they are reaping to-day to save it. The cotton they do not touch yet; the creatures look like brown grasshoppers; they cannot fly, for they have no wings, only the beginnings of them. The ground seems as if it was moving; they go in straight lines, over bushes walls, &c.; with them are longer ones with wings. They seem to be only grown-up ones, and these countless myriads, the young ones. Our compound, delightfully green with grass, looks this morning as if fire had scorched it; the grass stalks are bleached and stript. They are going in a north-easterly direction. It is a great cause for gratitude that the greater part of the crops are gathered: *varaku* and rice still remain. They do not eat the rice or *varaku*, but cut up the straw like mince meat, cutting off the heads of the grain." Two days later, he says: "Our crops are still being eaten with locusts; they are jumping by us still, headed north-east; not so many as before; but yet myriads. Yesterday the large flying kind were so thick as to look like a snow squall some of the time."

THE blight, so prevalent in the Madras Presidency, is undoubtedly in our opinion, the consequence of bad or diseased seed. We trust that the Government will take proper steps at once to supply the ryot with well-selected seed from Bengal or any other Presidency.

As evidence of the scarcity of fodder in the North-West Provinces, the *Pioneer* tells us that all the commoner trees far and wide are stripped of their leaves and bare as if from a hailstorm. The *peepul* and the *babul* have been cleared of every leaf, and in many instances mangoes have not escaped. Every conceivable thing that can be utilised as fodder is brought into market, even the dead leaves of the frostbitten *arhar*; and the cultivator carefully thins his field of all the plants likely to be unproductive of grain, even if he stays his hand at these. Grass is at famine prices, a miserable handful fetching two annas, and at the Makanpur Horse Fair a bundle, ordinarily obtainable for the same sum, could not be purchased under eight annas.

THAT there was no truth in the report spread some time ago of prospects of a bad harvest in Nepal is shown by the fact that prices have lately fallen considerably in Purneah owing to the importation of large quantities of grain from Nepal.

IT has been stated by some of our contemporaries that the Banglore Experimental Farm is to be abolished. We understand that the Mysore Commissioner has no intention of abolishing this Farm, which may, in course of time, develop into a training school for native agriculturists; but there are to be some reductions made, and Mr. Harman, the Superintendent, is to travel about to see the different methods of cultivation adopted by the natives.

NEWS has reached India that the Home authorities have, after much consideration, declined to endorse the action of the Government of India in respect of the proposed repeal of the Bombay Cotton Frauds Bill. A good deal of opposition has been raised to that step by many of the Lancashire cotton buyers and manufacturers, and Lord Salisbury has referred the subject back to Calcutta, asking that the matter should be further considered, together with the report of Colonel Moore (head of the Cotton Department in India) on this subject, which was not before the Government of India when they proposed the repeal of the Act.

WE hear that Mr. Andrew Wedderburn, Collector of Coimbatore, and the senior member of the Madras Civil Service, will retire next month, at the conclusion of thirty years of actual service. Our readers are indebted to him for many a valuable article on Indian Agriculture, on which subject Mr. Wedderburn has always taken the highest possible interest, setting a good example to his juniors in the service.

THE mills of Broach have stopped working on account of the scarcity of cotton.

THE Punjab Sugar Company having been advised of the arrival of its machinery from Europe, Mr. Halsey, the Superintendent, has come down to Calcutta to send it up. The company will start with the best possible tools.

THE Punjab Correspondent of the *Pioneer* writes regarding this Company:—"In the course of my letters I have incidentally mentioned the Punjab Sugar Company, but I have an idea that the project is not so well known as it deserves to be, both from its economic importance as introducing a vital change in the production of a staple article of food, and the opportunity it offers for remunerative investment. The works of this nature, in operation up to this time, of which those at Shahjehanpore and Cossipore are types, are rather sugar refineries than manufactories on a large scale, and the new project may be said to leave off where they begin. In the centre of a sugarcane-growing area of some 150,000 acres, extending over four districts, occupied by a dense population eager to dispose of its crops, where labour is abundant and cheap, and communications are good, and where unlimited water-power is available, machinery is being set up, the cane-crushing power of which is equal to producing sufficient juice to make ten tons of sugar per diem. This, it will be seen, is not a project for supplying the European community with refined loaf sugar for its afternoon tea, but for the supply of the native market, on a large and comprehensive scale. The native consumption of sugar, there is good reason for believing, is limited only by the supply, and when the sugar duties in Rajputana are removed, it is probable that the demand, already practically unlimited, will be largely increased. No contrast could be more complete than that between the creaking little *belna* or *kolu*, and the feeble tinkling that results from the bullocks slowly pacing their monotonous round, and the new company's cane mills driven by a water wheel of a hundred-horse power, transmitted from the Bari Doab Canal. The machinery by Messrs. Merrilees, Tait and Watson of Glasgow, is the most perfect that has yet been exported from the United Kingdom, and the arragements generally, especially those which concern the rapidity of the process of granulation and separation from molasses, &c., are unlike anything yet seen in India. The cane-juice, after expression in the mills just mentioned, is pumped into clarifiers heated by steam, in which it is defecated; and from these it passes into a series of open boilers, where its watery particles are partially evaporated; thence into a receptacle called an Aspinwall pan, where the already concentrated juice is deprived of such water as may remain by a final course of steaming, whence it travels into coolers, continually surrounded by cold water, which causes rapid granulation. Twenty-four hours afterwards the sugar is dug out and passed through machines with a centrifugal motion which expel the molasses and leave the sugar fit for the market. The molasses are run into tanks, and presently, in the still, undergo a transformation, rich and rare, into rum. I fear, I have not with any precision explained the action of the Aspinwall pan and the centrifugal machines on which so much turns, but the whole process is so rapid in its operation that the sugarcane may be one day waving its green spears of foliage in the sun, and thirty-six hours afterwards its juice will be ready for despatch to market as firm, dry sugar; while the fibrous refuse is drying to feed the boiler fires withal. So surely as the Briton will not be robbed of his beer, will the native eat as much sugar as he can get, nor can he find a better food. And it is the certain and ever-increasing demand for sugar which puts the Punjab Sugar Works Company in such a safe position. The whole of its machinery has arrived, and is being fixed, and work will be begun next October. At present I believe some of the larger kinds of cane are not crushed at all, and it was only the other day that a cultivator, banking up his stock with earth to keep it fresh and safe from frost till he found a market for it, told me, he thought the railway works, where they had all sorts of "injins," might crush it for him. The action of the company upon the cultivators cannot but be beneficial, for there is great room for improvement in sugarcane cultivation. The calculations on which the estimates have been framed are formed on a basis of production of a third of a ton of sugar per acre; whereas other sugar countries, with nothing like the same favourable conditions, give two and a half tons per acre. I believe it has been conclusively shown that with very little extra care in cultivation, the present Punjab average yield could be increased three-fold. It may seem that I have written in an unreasonably sanguine tone of this enterprise; but from its nature as benefiting a large number of people, and as an addition to the list of staples taken up profitably in the province, it is difficult not be sanguine. Flax has failed; there is little to be made out of cotton; but wheat is doing well; tea will be triumphant one day; beer is "spreading into lands" like Jacob; and surely for sugar and rum there is also a great future.

IN their last indigo report, Messrs J. Thomas & Co. give the result of the crop of last year, as far as can be ascertained from the invoices of European indigo, and the weights after inspection and sale of native indigo, of which there was no reliable invoice. They make the total quantity 151,200 maunds, or about 14,000 maunds in excess of the figures printed at the close of the manufacturing season, on the 26th October. No less than 13,000 maunds of this excess have been in Benares and the Doab, where three-fourths of the cultivation and manufacture is entirely in the hands of the natives, from whom it is impossible to get any reliable information. The crop of 1876-77 was 103,000 maunds. It is to be remarked that while Great Britian has taken only about 1,000 chests in excess of last year, and Germany, Holland, Belgium, Italy, Switzerland, and Russia even less, the exports to France have been nearly trebled, those to America nearly doubled, and to Suez and the Gulphs about three times as much as those of the previous season.

A COMPLAINT comes to us from Ootacamund and Bangalore that there has been a failure of potatoes and that there is not a sound potato to be had for love or money.

CONSIDERING the recent unfavorable seasons for gardening purposes, the Exhibition of the Madras Agri-Hortricultural Society which took place last month at the Society's Garden was, we hear, a very fair one, though, compared with its predecessors, it was very poor indeed, which could not well be otherwise. The flowers, both in quantity and quality, fell much below the mark of previous years, and the vegetables and fruit also did not, in any way, come up to those which were to be seen at former Shows. But, in one respect, the exhibition of the present year was a great success. The specimens of ferns and foliage plants exhibited were about the finest ever seen in Madras, and Mr. Potham Vencatachella Chetty and the Jaghriedar of Arnee are fully entitled to the commendation passed on them by the Judges, who were called upon to express an opinion on the class in which they competed for prizes. Some forest plants were exhibited by Dr. Biddie of a rare kind, as well as some plants grown from seed sent from Australia. A Brownia from Guindy was an excellent specimen, from, we believe, the only tree near Madras, which bears the beautiful blossom. A yellow lily exhibited was also admired as a rarity. A specimen of the plant which yields the Rhea fibre was exhibited by Mr. T. Hamilton Holmes, and had a very fine leaf; Government, it may be remembered, have offered a prize of Rs. 50,000 to any one who will invent the best machine for separating the fibre from the stem of this plant. In China this separation is performed by hand, and the fibre after the usual processes becomes, the beautiful china-grass silk. Of the vegetables displayed, were especially mentioned the celery, tomatoes (which were very fine), yams, carrots and turnips. The collection of fruits was not good, grapes being exceedingly poor. The apples and peaches were both very good. In the extra Prize List there was nothing worthy of note. The tobacco was poor, the coffee worse. Next year it is expected that there will be a much superior show, and that Madras will keep up its name as the first in India in this respect.

The results of the working of the Bangalore Experimental Farm, near the Lal Bagh, for the past year, is said to have been of a satisfactory nature. The cost of working the Farm was a little more than Rs. 10,000, exclusive of the Superintendent's salary, and the income amounted to upwards of Rs. 4,000. It has been estimated that during the year 1878-79, the receipts will cover the expenditure. The Head Overseer, Mr. Scott, has we believe given every satisfaction, and we believe the Superintendent considers him qualified to work a small branch farm himself. A few branch farms in the Province, says our Bangalore contemporary, and an Agricultural School in Bangalore, would do a great deal towards promoting a reformation in the Agriculture of Mysore.

We see, the new Egyptian (Bhamia) cotton appears likely to do well in Texas. From experiments conducted there, a yield of 2,500lbs. per acre of cotton in the seed was estimated. The soil in which the experiment was conducted was a light, fertile, sandy loam, in latitude 29° 40′. The cotton is described as of a pale yellow colour, excessive dew being set down as the probable cause for the discolouration.

One of the great drawbacks to the irrigation in Southern India would be overcome, if Sir Richard Temple's suggestion of constructing tanks capable of retaining a two years' supply of water were found feasible. The rivers in Northern India, fed by the eternal snows of the Himalayas, bring their tribute of water to the plains with ceaseless regularity. In Southern India there is no such perennial supply. When the mousoon fails the rivers are stunted at their sources; floods and freshes fail, and the tanks and canals in the plains are consequently liable to be dried up at the very time when most needed. The question of constructing reservoirs capable of containing a two years' supply of water is therefore of the greatest importance, and the Secretary of State directs that the Famine Commission should direct their attention to this as one of the vital questions connected with irrigation.

Mr. Hughes, the analytical chemist, whose services have been temporarily engaged by the Ceylon Planters' Association, writes regarding the analysis of soils: "From an experience of some fourteen years, nine of which were passed in the laboratory of the leading agricultural chemist in England, Dr. Voelcker, I may say that detailed analyses of soils are seldom made, indeed are not required; for the important points can be ascertained by a much simpler process, and with practical experience, one is able to recommend what manures are likely to give satisfactory results. To be practically useful, soil analyses should be made as simple as possible, not difficult and complicated."

Mr. Hughes gives the following directions for taking samples of soil for analysis:—Having selected a piece of ground, where the soil appears uniform in composition, take a cubic foot of the surface soil, or a large spadeful, to the depth of one foot, from at least six places in the selected spot; mix the six portions thoroughly together in some central place, and send about 2lbs. in a clean, wooden box. Each sample of soil should be numbered, and the box marked with the name of the estate and district in black letters. Samples should not be taken from recently manured ground; and where manure holes have been made in past years, great care must be taken to avoid such, when drawing samples.

For comparison, it will be very useful to send a sample of good coffee soil, which should be specially marked.

Information is requested as to the points mentioned below, in reference to such samples.

1. The elevation, and average rainfall—2. Situation as regards sun, wind, &c.—3. General appearance and character of subsoil—4. What kind of drainage—5. Number of years in coffee, —6. What manure and what quantity has been used, and note result of same—7. Is there any peculiarity about the soil—8. What are the average crop returns per acre—9 What is the natural tendency of the soil as regards production of wood, leaf and crop—10. State any general particulars respecting the past history and present condition of the soil that may be considered desirable.

The attention of the Madras Government has been drawn to the cultivation of Manilla hemp. From enquiries it appears, that it is not grown in the Madras Presidency, but wherever the common plantain flourishes, *Musa textilis* will probably flourish also. A few plants were distributed some years ago for experimental cultivation, and the Board of Revenue allege that they are *informed by their 3rd Member, that of the plants sent to him*, when he was Collector of Malabar, two were planted in his garden at Calicut and grew well, and that the plants might have been multiplied to any extent. Some were sent to a planter in the Wynaad, who was so much struck with their luxuriant growth and with the ease with which the plants could be multiplied from shoots, that he contemplated extensive cultivation with a view to the utilisation of the fibre. The Conservator of Forests also states, that the plant grows remarkably well in the Wynaad, and the Secretary, Agri-Horticultural Society, has testified to the ease with which it is propagated. The Board of Revenue, however, allege that they are unable to offer any opinion as to the practicability of extracting the fibre, or whether it could be produced of such quality as to compete with the hemp prepared in Manilla; some experiments in this direction, however, appear to have been undertaken by Captain Cox without success. The Collector of Malabar has therefore been requested to ascertain from him, what were the difficulties experienced, and whether he has any remarks to offer regarding the proposition of the Government of India as to the introduction of machinery, the Superintendent of Government Farms has also been requested to report on the subject.

The report of the Commissioner of the Neilgherries on the Government cinchona plantations, for the official year 1875-76, published elsewhere, is considered generally satisfactory, so far as the progress of the plants and the harvest of bark is concerned. Of the different species of plants grown, the majority consist of *cinchona officinalis* and *cinchona succirubra*, the latter being what Government appears to consider, the most important for cultivation, as it yields cinchonidine in very large quantities, and flourishes at a lower elevation and over a wider area, than other descriptions. On general questions dealt with by the report, such as those relating to the manufacture of cinchona alkaloids in the Neilgherries, the propriety of appointing a Quinologist in the place of Mr. Broughton, and to the sale of the plantations with a view of future cultivation being left entirely to private enterprise, we understand that the Secretary of State has requested, that the conclusions of the Madras Government may be reported to him at any early date.

MISCELLANEOUS NOTES.

Large supplies of refined white sugar, from Upper Burmah, are promised next year. The King imported the necessary machinery about five or six years ago, and has ordered 500 men to employ themselves solely in sugar cultivation this year.

We see that the estimated value of the 19,082 chests Bengal Opium, imported into Hong-Kong, is put down at $11,926,250, and of the 20,944 chests Malwa Opium, $14,137,200. The local consumption of Bengal Opium in Hong-Kong, during six months, was 9,050 chests, or an average of 150 chests a month.

We are informed that one of the firms of chemists and druggists in Madras, has manufactured a powder from raggi which is scarcely inferior, if at all, to the corn flour so generally used by all classes in this country; and although the price of corn flour is within the reach of every one, we believe that raggi flour, *if well prepared*, will compete favorably with it. *The following figures are* representatives of the nutritive value of the class of cereals from which the flour is made—

9 per cent. of Nitrogenous aliment
2·6 of Fat
74 of Carbon hydrates
2·3 of Salt.

The flour has long been in use among Indians, and is generally esteemed to be highly nutritive, and is used as a dietetic in chronic chest affections and debility.

MR. J. M. CAMPBELL, of the Bombay Civil Service, has drawn up a report on the wild herbs, fruits, seeds, &c., used during the famine as food in the Kaladgi district. The report has been annotated by Professor Gray, of the Grant Medical College ; and is published in the Government *Gazette.*

BENGAL jute-seed has been imported into Rangoon, for experimental cultivation in that province.

ALTHOUGH fibre-yielding plants are most plentiful in British Burmah, attempts to utilize them have apparently not succeeded ; for the advent of every rice-season, causes a large export of gunny fabrics from Calcutta to the Burmese rice ports. Three steamers, the *Tseekay Yjen Byan*, the *Pemba*, and *Comilla*, have within a few days, taken from Calcutta about one hundred thousand pieces of gunny.

MALAYA, we see, has sent to the Paris Universal Exhibition, thirteen packages, seven of which are from Penang, and the rest from Malacca, the Native States, and Singapore. The exhibits from Penang consists of krisses, spears, and other native weapons, samples of rum, sugar, woods, tapioca, tea, paddy, nutmegs, cloves cinnamon, mace, pepper, essential oils, mats, and silk and gold thread trousers, bajus, and sarongs of native manufacture. There are some 67 samples of woods from Penang, and some of the sarongs are very fine, one being valued at $100. Malacca has sent models of fishing stakes, specimens of palms, an interesting collection of some 76 samples of roots used by the Malays for the cure of various diseases, samples of tapioca, gum resin, gambier, baskets, woods, pine-apple thread, opium pipes, sumpitan or blow-pipes and arrows, &c. Singapore makes but a poor show, compared with the other two Settlements, the specimens of produce prepared not having been sent on account of the want of space, and also because Penang had collected and prepared specimens. Singapore is, therefore, represented only by some specimens of mats, bajus, sarongs, and handkerchiefs, mangrove-dyed cloth, and preserved fruits grown and prepared here. Some models of Malay houses and other native manufactures have not been sent, on account of the limited space alloted to the Colony.

A RHINOCEROS, from the Lal Bagh, Bangalore, has been sent to the Rajah's Gardens at Trevandrum. It was secured in a strong wooden cage made expressly for the purpose, and the cage was placed on a truck attached to a good's train. The truck went as far as Shoranore, from whence the Rhinoceros will be conveyed by road to Trevandrum, the cage in which it is secured moving on wheels.

THE Delhra Doon correspondent of a contemporary, states that some enormous *mahseer* have been pulled out of the Ganges about Hurdwar. The biggest of these fishes is said by him, to have been a comfortable load for two coolies—one man was not up to it ; and the smallest weighed 28lbs, when cleaned.

WE see it stated, that the Khedive has granted to a Dutch Company, the right of draining Lake Mareotis, and utilising the land reclaimed. Its area is about 75,000 acres, and the Company has bound itself to hand over to the Viceroy a certain proportion of the crops raised.

THE death of Dr. Sulpiz Kurz, who for many years past has held the post of Curator of the Herbarium at the Botanical Gardens at Calcutta, is announced. In his own favourite science, he took a high rank—his knowledge of the floras of Burmah, the Andamans, Nicobars, Java, and the neighbouring Malay regions being perhaps more extensive and intimate than that of any living botanist. A native of Bavaria, Dr. Kurz, came out to the East originally in the Dutch service, with the object of devoting himself to the studies of the Javanese flora. After a residence of some years at Bintensory he became acquainted with the late Dr. S. Anderson, then on a visit to the island, and was by him induced to quit the Dutch service for the appointment in the Calcutta gardens, which he held up to the time of his death. In the course of his service he paid prolonged visits to the forests of Burmah, the Andamans, and the Nicobars, the results of which have in part appeared in several papers contributed to the *Journal of the Asiatic Society of Bengal*, but were chiefly reserved for a work on the forest flora of Burmah, which was published a few weeks before his death. During his investigation of the Andaman forests, he was on one occasion abandoned by the convict crew who had been told off to accompany him, and to carry his collections. They left him without means of transport or subsistence, on the inhospitable shore of the Great Andaman at a distance of many miles from the settlement ; and it was only after two entire days of strenuous labour and semi-starvation that he succeeded in making his way through the tangled cane-brakes and mangroves of the coast, back to the harbour of Port Blair. As the result of his subsequent visit to the Nicobar islands, he was seized with a severe attack of the fever for which those islands are notorious. This, and perhaps also the accumulated effects of his long residence in the tropics, without the relief of even a short visit to Europe, had much undermined his health, and last November he left for a three months' trip to Java and the Malay coast, on privilege leave. On this journey he was seized with a fatal illness, and expired in the hospital of Penang on the 15th of January.

A COMPANY, called the Straits Sugar Company, has been established, whose head-quarters will be Penang, with a capital of £30,000, with the object of cleansing and purifying sugar on the Weinrich process, the patent for which has been purchased by the Directors. Most of the capital has been subscribed in London.

THE actual receipts from eleven sales of Bengal opium and ten months' duty on Malwa opium, have exceeded the estimated receipts by Rs. 56,90,510. The receipts from Bengal opium have been Rs. 55,34,130 better than the estimate, while those from Malwa opium have exceeded the estimates by Rs. 10,56,880.

WE understand that certain suggestions have been made by Mr. John Head, of the firm of Ransomes, Sims and Head, agricultural engineers in England, regarding the employment of steam threshing machines for the development of the trade in wheat in India, which suggestions are at present under the consideration of the Government of India.

HERR L. LOCZY, the geologist attached to Count Bela Szechanyi's expedition, arrived in Darjeeling on the 9th ultimo, and started for Sikkim on the 14th. This gentleman's principal object is the investigation of the glaciers and glacial formations to be found in such abundance in Independent Sikkim.

COMMUNICATED ARTICLES, &c.

ASHES AS MANURE.

BY DR. ATWATER.

Ashes vs. Phosphates and Guano.

I had a talk with a farmer friend in Vermont, recently, about ashes and phosphates as fertilizers. He had been using both, the superphosphate, of good quality, costing about $50 per ton, while fresh ashes could be had at 12 to 15 cents, and leached ashes at 10 to 12 cents per bushel. He was in doubt as to whether the phosphate paid, but was quite certain, the ashes were profitable. I thought the ashes cheap and the phosphate dear, and advised him to use the ashes, and very freely. I believe practical experience and correct theory justify this advice.

Very common experience shows that wood ashes are an excellent, reliable, and lasting fertilizer. Hundreds of farmers will recall places where a brush heap or an old log has been burned, and a luxuriant vegetation has followed and lasted for years. In this section it is an old saying that "the land never forgets ashes." Many of our best farmers in Connecticut use leached ashes, imported from Canada, at a cost of from 18 to 28 cents or more per bushel, in preference to all other fertilizers except barn-yard and stable manure. Mr. T. B. Wakeman, of Westport, one of the most successful farmers in the State, says:

"The farmers here have used ashes for more than thirty years: the cheapest manure we can buy. Over 30,000 bushels were sold here last year, besides 400 tons of bone, which is next to ashes as a fertilizer. We know that ashes and bone-dust pay, and more than three times over. We can put that down as a fact, and prove it, too. If any one doubts it, and will call and see our crops, when growing, he will admit its truth."

THIS good effect of ashes is very easy to explain. The trees from which they come subsist in essentially the same way as the cultivated crops. Both require the same materials for food, though in somewhat different proportions, and obtain them from the same sources—atmosphere and soil. The ash that is left after the wood is burned, includes, practically, everything that the tree took, and the plant requires, from the soil, except nitrogen, and the ingredients are in very available forms. Further, while the ashes do not supply nitrogen themselves, they are very active agents in rendering the nitrogen of the soil available to crops. Our ordinary soils contain this precious ingredient largely in excess of the needs of the crops. But the larger portion of it is in such forms that plants can not appropriate it for food. This is the case in partially decayed vegetable matter, as roots, stubble, humus, etc. Ashes induce chemical changes by which the nitrogen is rendered available. They do the same for the other soil ingredients of plant-food also. In the fragments of minerals and rocks contained in every ordinary soil are locked up stores of potash, lime, magnesia, phospohric acid and so on. The ashes liberate these, and work them over into forms fit for the support of plants. These changes of plant-food from inert to active forms, are going on in the soil all the while. It is in virtue of these processes that our soils are enriched by tillage and fallowing. Ashes, by accelerating these changes, enable the soil to feed the crops it bears more rapidly, or what is the same thing, more bountifully than it otherwise could.

Again, ashes may be useful as a mechanical amendment to the soil. On a portion of one of the fields belonging to my friend alluded to, ashes had been applied. On comparing this with an adjoining strip where no ashes had been used, a great difference in the texture of the soil, a somewhat sandy loam, was noticeable. Where the ashes were, the soil was soft and yielding to the step. We could run our fingers down into it several inches, and dig up large handfuls with ease. Where no ashes had been applied, it was harder and more compact, and it was with difficulty that we could force our fingers into it more than an inch or two. An acquaintance was telling me, recently, of some of the farming land in New Jersey that has been so wonderfully improved by the application of marl. He said he could tell the soil where the marl had been put, by the tread, when walking over it, even in the darkest night. The marl he referred to was somewhat similar in composition to leached ashes, and its application produced analogous effects.

And, finally, ashes are usually applied in large quantities. Of course, none of their constituents can escape into the air. The loss through leaching away in the water which percolates through the soil is very slight. They therefore remain, furnishing the crops with plant-food, and improving the condition of the soil for years, until they are themselves consumed. Hence their lasting usefulness.

BELOW are figures by Wolff, representing averages of European analyses (mostly German) of wood ashes. Analyses of ashes of peat and anthracite coal are also given, for comparison.

ASHES FROM 100lbs. contain	Water.	Potash	Soda.	Lime.	Magnesia.	Phosphoric Acid.	Sulphuric Acid.	Silica & Sand	Chlorine and Fluorine.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Evergreen Trees	5·0	6·0	2·0	35·0	6·0	4·5	1·6	18·0	0·3
Deciduous Trees	5·0	10·0	2·5	30·0	5·0	6·5	1·6	18·0	0·3
Leached Ashes	30·0	2·5	1·3	24·5	2·5	6·0	0·3	20·0	..
Peat	5·0	1·5	0·8	?	1·5	0·6	1·8	?	0·2
Anthracite Coal	5·0	0·1	0·1	?	3·0	0·1	5·0	?	..

The above analyses of wood ashes differ somewhat from those of the ashes ordinarily produced in household and furnace fires. The percentages of phosphoric acid, particularly, are much higher than those of common wood ashes.* The amounts of phosphoric acid, as well as some of the other constituents of ordinary wood ashes as obtained from household fires in this country, are illustrated by the following analyses by Prof. Storer.† Nos. I and II were "from soap-boilers' stores," and of course, mixtures of various kinds as gathered promiscuously from houses. The rest were carefully taken from stoves and furnaces in private dwellings in New England, except IX and X, which were from Illinois.

WOOD ASHES, (Unleached.) SOURCES, KINDS OF WOOD, ETC. 100 lbs. contain.	Potash.	Phosphoric Acid.	Carbonic Acid.	Sand and Charcoal
SOAP-BOILER'S ASHES.	lbs.	lbs.	lbs.	lbs.
I.—Collected from Houses	6·3	3·4	..	..
II.— " " "	6·1	3·0	..	..
FROM HOT-AIR FURNACES IN HOUSES.				
III.—Beech, Birch, and Maple, mixed	10·4	1·5	25·4	5·9
IV.—Hard Wood, chiefly Oak	8·5	1·7	21·9	14·1
VI.—Rock Maple	8·8	2·0	28·7	1·2
FROM HOUSE STOVES.				
V.—Mostly Red Oak, (open fire)	8·8	2·0	31·7	7·8
VII.—Maple and Apple	8·4	1·8	..	..
VIII.—Beech	9·5	2·8	..	..
IX.—Pin Oak, (green wood)	9·0	2·2	22·4	11·9
X.—Pin Oak, (dry wood)	7·4	0·7	20·3	5·1
XI.—Apple, (old trees)	9·1	0·4	28·3	2·7
XII.—Pitch Pine	10·8	4·2	..	..
XIII.—Alder	6·8	2·3	..	..

Leached ashes differ from unleached chiefly in containing less potash and more water. Below are some analyses by Prof. Johnson ‡

LEACHED WOOD ASHES. 100lbs. Contain.	Water.	Potash.	Soda.	Lime.	Magnesia.	Phosphoric Acid.	Sulphuric Acid.	Carbonic Acid.	Sand, Coal, &c.
Sample from	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs.	lbs.	lbs.
Deer River, N. Y.	35·0	0·8	0·2	29·7	3·4	1·3	0·0	19·9	8·9
Canada	35·0	2·3	0·0	26·1	3·3	1·3	0·2	18·2	9·9
Canada	35·0	0·7	0·0	28·2	2·9	1·4	0·1	17·1	18·1
Soap Factory, New Haven, Ct.	35·0	0·9		21·3	4·1	1·1	0·1	20·2	30·7

From the above analyses and other data, which we have not room to discuss here, we may assume the following figures as expressing accurately enough for practical purposes the average percentages of the valuable ingredients of plant-food in wood ashes as obtained from household fires, or commercially, in this country.

WOOD ASHES, 100lbs. contain on the average.	Potash.	Lime	Magnesia.	Phosphoric Acid.	Sulphuric Acid.
	lbs.	lbs.	lbs.	lbs.	lbs.
Unleached	7 to 10	32	5	2	1½
Leached	1 to 2	25	3½	1½	1·5

A bushel of unleached ashes weighs, on the average, about 48lbs. A "struck" bushel of leached ashes will average some 57lbs., and a "heaped bushel" about 71lbs. A dressing of 50 bushels of unleached ashes to the acre, at 48lbs. to the bushel, would give some 200lbs. of potash; 768lbs. lime; 120lbs. magnesia; 48lbs. of phosphoric acid and 36lbs. of sulphuric acid. A manuring of 60 bushels of leached ashes at 60lbs. to the bushel, would furnish about 54lbs. of potash, 900lbs. of lime; 126lbs. of magnesia; 54lbs. of phosphoric acid, 7lbs. of sulphuric acid. Either of these would cost but little more, and, in many places, not nearly as much as an ordinary dressing of guano or superphosphate. The main value of the guano or superphosphate would be in the nitrogen and phosphoric acid it contains and supplies directly to the plant The ashes would contain about as much phosphoric acid, and would supply nitrogen indirectly, as explained above In addition to this, the ashes would yield a large quantity of potash, of which the guano would contain little, and the phosphate probably none, considerable magnesia, and a very large amount of lime. The guano and phosphate would probably be more rapid in their action, but their effect would soon be gone, while that of the ashes would last for years.

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* The reason of this is that the analyses refer more to the ash as prepared for investigation, by careful burning in the laboratory, so that all the phosphorus of the wood remains in the ash as phosphoric acid. In ordinary fires a good deal of the phosphorus of the wood is lost, by being volatilized and carried away in the draft, or changed to other forms of combination than phosphoric acid. Household and furnace ashes also contain considerable coal sand and other impurities, which do not occur in the samples prepared in the laboratory. Wolff's figures, above given, evidently make allowance for these latter contaminations, however.

† An exhaustive treatment of this subject by Prof. Storer may be found in the "Bulletin of the Bussey Institution of Harvard University," Vol. I, page 191. See also accounts of composition and fertilizing effects of ashes in other parts of same work.

‡ From Report of Conn. Board of Agriculture, 1872, p. 417 The original samples varied in the percentages of water, but the analyses are calculated on a basis of 35 per cent. which is probably a fair average. The last sample had an admixture of anthracite coal ashes.

A WORD of practical application. Ashes are useful for any crop from roots to fruit. On newly seeded grass land they often work wonders. They may be used as a top-dressing or put in the hill or ploughed or harrowed under. They are excellent for composts also. Here in Connecticut, where guano, phosphates, fish, and the like, can be bought very cheaply, many of the best farmers prefer to use ashes, even when they have to pay twenty cents per bushel or more for the leached. And where, as in some places I know, guano costs $70 00, a good superphosphate $45 00 or $50 00 and bone about as much per ton, and ashes are only 12 to 18 cents per bushel, I should advise the use of the ashes by all means Of course, for forcing early crops, guano, phosphates, and other quickly acting fertilisers, when used in small quantities, may pay better But, generally speaking, at such prices as the above, ashes will be far preferable for a standard manure.

MR. ROBERTSON'S REPORT ON THE AGRICULTURAL CONDITION OF THE COIMBATORE DISTRICT.

IN Government Order. No. 1,550, dated the 1st November 1875, I was directed to undertake a tour through the Coimbatore District, in view to collecting information regarding its agriculture

The area of the district is 7,432 square miles, of which 1,298 square miles consists of Government forests, hill tracts, waste land and permanently-assessed properties, the remainder, 6,134 square miles, or, 3,925,760 acres is Government land under *ryotwary* tenure but, of this, rent is paid only for 2,200 000 acres, leaving 1 725 760 acres of *ryotwary* land, from which no revenue whatever is derived

The occupied area is held under 215,2[illegible]7 *ryotwary* leases as below —

Rent.			In 1871-72	
			Number of Leases	Total Amount
Below	10 Rupees	... ...	112 455	7,07 293
From Rs.	10 to Rs. 30	... ...	57,188	9 00,93[illegible]
„ „	30 to „ 50	. ... .	9,602	3,1[illegible]
„ „	50 to „ 100	. .	4,628	2,97 771
„ „	100 to „ 250	.	1 199	1 66,558
„ „	250 to „ 500	... ...	152	18 510
„ „	500 to „ 1,000	...	26	18,119
Above „	1,000 Rupees	.	7	11 182
		Total ...	215,2[illegible]7	24,99,33[illegible]

From the foregoing, it would appear that, the average rent of a holding is about Rupees 11½ per annum, as, the average rent over the whole district is, about 15 annas, per acre, one of these holdings will be about 12 acres in extent. It will be seen that there are a considerable number of good sized holdings, thus,—

9,602 holdings, each of an area between 30 and 50 acres
4,628 „ „ „ „ „ „ 50 „ 100 „
1,199 „ „ „ „ „ „ 100 „ 250 „
152 „ „ „ „ „ „ 250 to 500 „
33 „ „ above 500 acres in extent

It is true that in some instances a holding may be held in a joint tenancy by two or more persons but, on the other hand, several of the smaller holdings may be held by one person. At the last Census in 1871 the population of the district was 1,763 274 [illegible] per square mile. The population of the district in 1851-52 was 1,153,862, but this included about 20,000 persons who inhabited the Neilgherry Hills, deducting these, the population of Coimbatore was in 1851-52—1,133,862; the increase in the population in the last twenty years was thus 629,412 persons, or 55½ per cent.

The whole of my travelling was performed during daylight, so that, I was enabled to see the country and inspect everything of interest I, usually, camped for a few days in places that appeared suited as centres from which to inspect the neighbouring land, and from these, I made short tours into the surrounding country. The distance apart of these observation centres varied from 15 to 30 miles. I usually visited the ryots at their villages, the inspection of the land belonging to these villages was performed in company with as many of the ryots as chose to accompany me During such inspections various topics were discussed bearing on the condition of the country around, the agricultural practice of the locality, &c In some places, the ryots came in large numbers to my camp. I did not trust alone, to the information I collected at those gatherings but, availed myself of the frequent opportunities afforded, while passing through the country, of picking up facts from the ryots, whom I found engaged in the fields.

Around the principal towns the country is usually well wooded, and all the chief roads are bordered by trees, but throughout the district, generally, the landscape is exceedingly bare. In some places the rich growth of vegetation on the land irrigated by rivers and wells, forms a redeeming feature in the landscape, however, the amount of land under the influences of irrigation forms but an exceedingly small proportion of the whole area. I was surprised to find the banks of the chief rivers almost without trees. The Bhowany, a few miles above Mettapollium has some fine trees growing near it, but these are confined chiefly to the lower portions of the valley, the higher slopes are generally covered only with low growing bushes, chiefly acacias; further down between Sattiamangalam and the town of Bhowany the banks of the river are almost bare, the banks of the Ambravuty, of the Noyel, and of the Cauvery are equally destitute of trees Most of the large jungle streams have on their banks narrow fringes of scrub jungle, but it is rare indeed that any good trees are met with in such situations. I saw but little natural forest during my tour, excepting that, growing on the slopes of the Annamalay and the Neilgherry ranges. Of dense jungle, I also saw but little, I passed through several of the so-called jungles, but they are so exceedingly open a horseman could ride through them in almost any direction. These jungles consisted chiefly of acacia bushes scattered apart at wide intervals over the ground, the undergrowth is apparently kept in check by the cattle and goats of the ryots living in the neighbourhood, of pasturage there is but little in these jungles, the grasses chiefly met with being coarse reedy varieties useless as fodder except, when quite young. These jungles, would undoubtedly have been cleared long ago had the land possessed any value. A much worse description of jungle and one, which occupies far too extensive an area in this district, is that formed of the prickly pear In some places energetic measures appear to have been taken to annihilate this pest but, there are still large areas of land covered by it. Much good agricultural land has been rendered temporarily useless from having been taken possession of by the prickly pear. Ryots have done much to spread this troublesome pest by using it in so many instances for fencing purposes In some parts of the district the fields are divided by belts of prickly pear sometimes of many yards in width It has been denied that the ryots ever plant the prickly pear for fencing purposes, but I saw during my tour many newly formed fences, and others, in all stages of growth. Again and again I pointed out to the ryots the serious mistake they were making in allowing so much useful land to remain covered by this pernicious plant, but they seemed [illegible] recognize the evil that arose therefrom, though, when advised to plant trees for the supply of fuel for their own use, they invariably expressed, how glad they would be to do so, could they but obtain the necessary land, and yet, many of them had land growing prickly pear that would have sufficed to provide all the fuel they ever could require for their ordinary domestic wants But the overgrowth of prickly pear is not confined to agricultural land, but extends to much of the waste land within and bordering many of the villages, growing under such circumstances it cannot but be highly pernicious to health, especially as the ground under prickly pear is, in such situations, the refuse dêpôt of the village In some places, the ryots excuse themselves for having large belts of prickly pear around their fields on the ground that they would not be permitted to remove those belts as, they formed demarcation lines or boundaries but I have reason to believe that if, the ryots were really in earnest in a desire to get rid of the prickly pear that, they would experience no difficulty on the ground advanced I was sorry to observe in many parts of the district that those entrusted with the management of the roads are blamable to some extent for the extension of the prickly pear nuisance On some of the roads for miles on either side at intervals of form 10 to 30 yards, I saw pits which had been dug in excavating road gravel which are now full of luxuriant prickly pear Many of these pits being situated so close together that the intervening land cannot be tilled and this, in time, becomes covered with prickly pear by the spreading of the plants growing in the pits. It seems a great pity to have agricultural land disfigured and injured by these gravel pits, to many of these roads, margin drains would be of great service for carrying off water after heavy rain and, there would be no practical difficulty, in most instances, in obtaining the material needed for road repairs by cutting these drains, as the material appears to be met with, generally, very near the surface, The general absence of plantations of fruit or fuel trees and the almost complete absence of trees in the ordinary villages shows how very unenterprising are the people. Of the occupied area, 2 200,000 acres, there are only 5 000 acres under plantations of this sort. It is true that, the climate of Coimbatore is not particularly favorable to the growth of trees but, there are no difficulties to be encountered that cannot be overcome by the expenditure of a little labor which, it would be in the power of most ryots to afford, seeing that, it would be chiefly demanded of them at the season of the year when they have but little work to do in their fields. Near the towns of Coimbatore, Darapuram, Bhowany, Caroor, and one or two others, there are many trees of very large growth, the mango trees specially at Bhowany and Darapuram were very fine. The production of trees over the district is, I think, essential to the well-being of its agriculture. As a beginning, in Tree-Planting, Government might establish a number of *camping topes*, in different parts of the district, such *topes* should be situated at about

10 miles apart along the principal roads, and each should be provided with a well. These *topes* would afford hints to the ryots, in tree-planting, and if, placed under the charge of the officers of the village to which the land was attached the expense of maintenance would be trifling; the *topes* would be remunerative in time, in the fruit from the proceeds obtained for fuel, and, rent the camping fees. In many parts of the district there are no public *Bungalows* and, in other parts, the public *Bungalows* have been rented for private occupation. I found tent-life almost unendurable in the months of March and April when, the tents had to be pitched in open ground exposed to the full glare of the sun. In some places I had no choice but to pitch my tents on the road-side, in order to secure such shade as the road side trees afforded. It is generally asserted by the ryots that during the past 30 years an immense area of land which was covered with trees and bushes of a jungly growth, has been cleared, partly in view to the extension of arable culture and, partly to afford fuel, for the railways, and, to meet the largely increased domestic demand. I was shown large tracts of country which the people, declared was under jungle only 20 or 30 years ago.

It is certainly the fact that, *upwards of 700,000 acres of land which was growing jungle scrub and coarse grass has, during the past 18 years only, been brought under the plough*, and this, must have influenced the climate of the district, seeing that the land thus brought into cultivation is perfectly bare during two-thirds of the year. The people were unanimous in stating that the rainfall had been gradually diminishing during the last 20 or 25 years, in some places they appeared to connect this diminution in the rainfall with the denudation of the country, though this was the case only in occasional instances. The evidences brought forward of the smaller rainfall during the last few years in comparison with that of the earlier part of the period before mentioned consisted chiefly of facts relating to the flow of certain jungle streams. I was shown streams which now cease flowing invariably before the end of December that, 20 or 30 years ago were said to have flowed regularly up to the end of February. This matter I think, demands the serious attention of all interested in the welfare of the country. I am aware that it is asserted that the rain registrations made during a great number of years, in this Presidency, show no perceptible diminution in the rainfall but, if this is the case, it must be remembered that, these rain registrations have been made for a long period, only at very few places; that until lately the rain gauges used were imperfect, and the observers, untrained, and that, the localities in which these registrations were made, were generally well wooded, being in most instances the head quarters of a district. *Rain registrations made in a well wooded part of a district are not likely to show the effect produced by the denudation of another portion 20 or 30 miles distant.* It is well known how greatly the fall of rain is influenced by local conditions. At Sydapet, the rainfall differs from that registered at the Madras Observatory, though, the distance between the two places is only five miles. On most occasions when I met an assembly of ryots I directed attention to the great importance of tree planting, in view to the production of fruit and of fuel, the improvement of the climate and, the protection of live-stock by affording shelter during severe weather, &c. but though, the people generally agreed with me in the views I expressed, they evinced but little desire to carry them into effect. In one place, after addressing a large assembly of ryots under the shade of a tree, I was informed by a ryot and the rest appeared to agree with him that trees would not grow in that locality. I immediately asked what had caused the tree to grow under which we were then standing, and they replied that, "it had come by itself, as, the tree was bearing seed, at the time, I advised them to collect the seed and to plant it with due care, under the necessary conditions to ensure germination but, they protested that it would be quite useless to sow the seed for, "the tree only came by itself." I am convinced that if proper means were taken, there would be no difficulty whatever, in clothing with trees, the greater part of the district where trees are needed but, to produce this result, the ryots living in those places must be distinctly informed that, they must plant and rear a certain number of trees for each acre of land under occupation, or that the State will plant and rear the trees at the expense of the ryot. If the State is bound to support the ryot during famine seasons, it certainly has a right to expect that he will take such precautions as are in his power to make these famine seasons as less frequent as possible. On two or three occasions when discussing this question at ryot gatherings the people said that, if Government ordered them to plant and rear trees that they would do so. It would, I think, be doing a kindness to the people to compel them to plant a certain number of trees, on all their holdings, where trees are needed, the trees of course, to be the property of the people who plant and rear them but, restrictions to be laid down as to felling, &c. The trees need not interfere to any extent with the area of land under cultivation. There is all over the district where these are needed, sufficient waste land to produce the trees required. In speaking of "waste" land I do not use the word waste as it is understood in the revenue classification but, in its ordinary sense, there is a very considerable area of the so-called cultivatable land which is, to all intents and purposes, waste and which might be cropped with trees. I have mentioned that the landscape of the district is exceedingly bare but this, conveys but an imperfect impression of the actual appearance of the country. In the unirrigated tracts there are but few spots on which the eye can rest with pleasure. From rising ground in many places no tree can be seen for miles, excepting perhaps, those bordering a chief road. Much of the arable land is lying untilled, temporarily abandoned, and this land has a very untidy appearance from the bushes and tufts of wild vegetation which, spring up on it. In passing through the country I looked in vain for those evidences of enterprise, and industry which are supposed to be characteristic of small farming. Everywhere, were evidences of neglected opportunities. In Ireland, when on a tour of a kind somewhat similar to that I am now referring to, I was frequently shown most satisfactory evidences of what can be done by peasant cultivators, towards the improvement of land; again and again, I saw improvements which could have been effected at a moderate cost, by no other means, and which, were amply repaying the enterprising people who had made them, and, similar experiences are common in most European countries. The ryot, in his management of land, falls far short of the peasant cultivator of most other countries. I do not lose sight of the fact that in some places, the ryot has done a good deal more for the land than, merely to perform the acts of cultivation, the wells have, I am aware, been sunk entirely at the expense of the ryot; and, the terraced land under irrigation has, also, been laid out at his cost but, the total area of land in this district, influenced by these improvements, is not 200,000 acres leaving 2,000,000 acres of occupied land altogether untouched by such improvements. It has been said that a peasant cultivator, when holding land on a secure tenure, will convert a wilderness into a garden but, that, such is not always the case, is amply evident from the condition of much of the agricultural land in this district. I have long held the opinion and my experience in this country has amply verified it that, security of land tenure alone, will not suffice to ensure good farming.

The condition of most of the agricultural villages, is very unsatisfactory. In most civilized countries the village is associated with all that is healthful and pleasant but, the majority of the villages I passed through during my tour, are characterized by conditions quite the reverse of these and this, was specially noticeable after my brief sojourn in the town of Coimbatore, the sanitary state of which has reached such perfection. Not only do most of the villagers live in wretched hovels in which, it is almost impossible that good health can be secured but, from the untidy and dirty habits of the people, everything around these hovels tends to the production of ill-health. I am aware that many of the inhabitants of these villages have nothing to spend further than suffices for bare existence but, I am also aware that, most of these people have during the long dry season, a great deal of unoccupied time at their disposal which, it might, reasonably, be expected, they would utilize in improving their dwellings, and the state of the surrounding ground. If it is true, and I have every reason to believe that it is, that the working members of these village communities lose, on the average, in the year, from four to six weeks' labor earnings, from sickness, produced by the bad sanitary conditions of these villages the people, would have great cause for thankfulness if, some measures could be devised, by the employment of sanitary police or other means, which, would ensure better sanitary conditions. I speak thus of the villages from a very unpleasant personal acquaintance with many of them. In passing through the country, especially in the early morning one of the first indications that we were approaching a village was, a sickly odour of decomposing excreta. I consider that the bad sanitary conditions of most of the villages is, *a great agricultural evil*. From the sickness that results, the people do not enjoy that robust health which, is so essential for the proper performance of out-of-door agricultural duties and, frequently they are incapacitated for physical exertions, at the most important agricultural season of the year. I camped near, and, passed through, many villages in which, it was impossible to obtain any water fit for drinking. In many of these villages the chief water supply for the inhabitants was a tank-well, which derived its water chiefly from the drainage of the surface excreta-saturated-land adjoining, whenever the rainfall was sufficiently heavy. Surely, in regard to the improvement of the water-supply for drinking purposes, something can be effected, if, the people cannot afford to pay the cost of making any needful improvements, they can themselves at any rate, afford the labor. Each village had better work for one week in the year, in aiding in the improvement of the sanitary condition of the village, than that each working villager should lose from sickness, at least from four to six weeks' wages in the year, and have his or her constitution undermined. The villages to which irrigated land was attached were in most instances, much superior to those just referred to. Not only were the dwellings larger and more substantial but, they were much more tidy and cleanly; however, these villages are but very few in number, in comparison with the number of villages in the district. As far as could be learnt from observation, the people, generally, in the unirrigated parts of the district appeared to possess but few resources, upon which to fall back in times of scarcity. The stack yards of villages to which wet land is attached were generally, well filled, but, in the unirrigated parts of the country, I frequently travelled for miles without seeing a stack of any sort and, it must be remembered that, at the time of my tour, a very considerable proportion of the cereal crops had just been gathered. However, judging from the appearance of the crops that were then standing, it would require the produce of many acres to make a medium-sized stack. The general opinion I formed of this district was very different from the opinion I held of it before going on the tour. I had frequently passed on the Railway through the portion of the district between Erode and Mettapollium and, I had also travelled along the line between Erode and Caroor; and, from what I had then seen, it appeared to me that the district was a flourishing one from an agricultural point of view, however, I now know, that the Railway line passes through some of the most favored portions which, are irrigated by the perennial rivers, Bhowany and Noyel. Between Erode and Caroor, the Calingaroyen channel accompanies the Railway line almost the entire distance and, near Pothanore the water of the Noyel channel, on the fertile land in the neighbourhood, produces a most luxuriant vegetable growth. Observations made of a country from a Railway carriage, when travelling at the usual speed, are often most misleading. I was particularly struck in regard to this, from having an opportunity of afterwards examining, in the fields, some of the crops which, I had seen from the Railway train when going to Coimbatore from Madras. Not only do the crops appear much better than they really are but, the area under crop seems much greater than it really is, patches of irrigated land of two or three acres in extent, are seen and noted and, the impression dwells in the mind while, hundreds of acres of untilled waste pass unobserved.

The Farming of the Land irrigated by Rivers and Tanks, &c.

In the Coimbatore district, irrigated land forms only about 4 per cent. of the land under cultivation but, it pays one quarter of the entire land revenue of the district. The average rent derived from this irrigated land is about 7½ rupees per acre, whereas, the average rent of the dry land under cultivation is only about 14½ annas per acre. The total area of land in this district, irrigated by means of rivers and tanks, is 106,187 acres, of this 10,490 acres is *Inam* land, and 7,075 acres is waste; the area of Government land under culture is only 88,622 acres. The following shows the irrigation sources:—

	Area, Acres.
The Cauvery River	4,158
,, Bhowany River	25,679
,, Ambravutty River	21,056
,, Auliar River	4,243
,, Noyel River	14,904
,, Jungle Streams	5,779
,, Rainfed Tanks	12,803
Total ...	88,622

I gave much attention to the chief rivers of the district. The Bhowany, I met with first at about ten miles to the west of Mettapollium, and followed it down to several miles to the east of that town; I again met with it at Sattiamangalum from which place I followed it to the town of Bhowany where, it joins the Cauvery. From Bhowany I followed the Calingaroyen channel down to the Noyel river about twelve miles to the north-west of the town of Caroor. I saw the Cauvery at Bhowany and again near Nerur. At Caroor I met with the Ambravutty which, I followed for some distance; I again travelled along its banks in the Darapuram *taluq*. The Noyel river I saw, near the town of Coimbatore, at Payrur at about six miles to the south of Avenashy, and again, where it joins the Cauvery. The Palaur and Auliar rivers, I met with at the foot of the Annamalay Hills a few miles to the south of the town of Pollachy. At the time of my tour, the Bhowany and the Cauvery were the only rivers in which there was a moderately good flow of water. The Noyel river was flowing only for a short distance beyond Payrur; lower down, at another place where I saw it, about six miles to the south of Avenashy, the bed of the river was dry in many places while, at its lower end near the Cauvery there was no water whatever. The bed of the Ambravutty near Caroor was dry but, further up near Darapuram and as much further up as I went, there was a small flow of water. The beds of the Palaur and Auliar rivers were nearly dry. The wet cultivation under rivers, in operation at the time of my visit, was therefore confined to the land watered by the river Bhowany and its irrigation channels, some land watered by a channel of the Cauvery near Nerur, a few blocks of land in the neighbourhood of Darapuram watered by the Ambravutty, and the land in the neighbourhood of Pothanore and Coimbatore watered by the Noyel river.

It has been stated that the river irrigation supply in Coimbatore is thoroughly utilized as far as this is possible, but the results of my observations lead me to form a different conclusion. Irrigation water is the one great want of the district and I feel convinced that, no great difficulty would be experienced in increasing considerably the area of land under river irrigation. The drainage of nearly the whole district is towards the east into the Cauvery, which must, after heavy rains receive immense volumes of water from the Coimbatore district, judging from the great width of the beds of the streams near their junction with the Cauvery, and the recent evidences they show of high floods.

It may be true that the drainage water from Coimbatore produces in Tanjore, as good results as it could have effected in the Coimbatore district, but while Tanjore would not suffer to any serious extent from losing the water, Coimbatore would benefit very largely from retaining it, or the greater portion of it.

The area, irrigated by river water, might be very considerably increased with the water now available for irrigation if, the cultivators could be induced or compelled, to use the water in a less lavish and wasteful way than is now universally the practice, where the only trouble connected with the application of the irrigation water is, the raising of a sluice door.

The land under river irrigation is almost exclusively cropped with paddy; raggy is sometimes grown upon it but, this is only occasionally and, when there is any doubt as to their being sufficient water to mature a crop of paddy.

The largest quantity of paddy is produced in the Erode and Sattiamungalam *taluqs*, under irrigation from the Bhowany river. The next largest producers of paddy are the Caroor, Darapuram and Oodumulpettah *taluqs*, in these *taluqs* the Ambravutty supplies the irrigation water. During the official year 1874 75 there were 72,000 acres under paddy. There is nothing worth special notice in the cultivation of the irrigated land, it differs in no respect from the practice in other parts of the presidency.

The usual practice when irrigating paddy with water supplied by gravitation is, to apply daily a quantity sufficient to cover the ground to a depth of two inches, half of this, or, one inch in depth, the ryots say, is absorbed by the soil and, the other inch flows off upon the neighbouring land, the owner of which, takes from the distributing channel another inch, in order that his land may be covered to a depth of two inches; he, in his turn, passes off half of the water to his neighbour's land. In this way, the quantity of water actually consumed is, a depth of one inch, daily, over the area under crop, or, for raising and maturing an acre of five months' paddy, a volume of water, *one acre in area and twelve feet deep*, is required. Such a deluge of water would ruin any ordinary land situated on the level but, fortunately for the cultivators of the irrigated land the water is, in most instances, at a much higher altitude than the irrigated land, and this has a limited of the land being laid out in terraces, in this way, the possibility of the irrigation water accumulating on, or in, the land, to an extent to prove injurious is provided against.

I am convinced that on most of the irrigated lands were the soil properly tilled and manured, there would be no difficulty whatever in producing as good crops of paddy as are now grown, with one third or at the outside, one-half of the quantity of water now usually employed

On terraced land when the soil is not properly tilled, not manured, or manured only with exceedingly small dressings, it undoubtedly pays the ryot to use the irrigation water *very* freely, *provided, it contains silt*. In such cases the water, to some extent, supplies the place of the manure. The terraced paddy land, is not likely to be brought into a swampy state whatever quantity of water is applied. The terraces are so many filter-beds placed in the form of steps, the highest being, of course, nearest to the irrigation source.

When the rivers are in flood their waters, I am informed, contain a very large quantity of suspended silty matter and, at the time of my tour, though there had been no rain for two months or more, the water of each of the rivers when placed in a vessel and left undisturbed for a few hours deposited a distinct layer of fine silt. The beds of the rivers, as far as I saw, afforded but little evidence that, much silt is brought down, but, this absence of silt deposits in the river beds may, I think, be due to the rapidity of the current, during the time of floods. A large amount of silt may be deposited on the land, by the irrigation water from these rivers, and yet there may be but little evidence in the river beds that silt is brought down. A rapid current may prevent the deposit of the suspended silt, until the water reaches the field and becomes stationary. An enormous amount of silt is undoubtedly brought down into the low country by the rivers that rise in the Neilgherries, and the other high ranges of hills; the cultivators of land on the slopes of the Neilgherries know to their cost, what a quantity of fine soil is, during heavy rains, washed down the slopes into the neighbouring streams.

In one or two places where, at the time of my visit, the irrigation water used was almost clear, I found some luxuriant paddy crops, growing on land which had not received any manure for years, excepting, a few cart-loads, per acre, of the green plant of mudder and wild indigo. In these instances the crops may have been feeding on silt previously deposited, brought into activity by the irrigation water. It is of course possible for a water to be clear and yet for it to possess highly fertilizing properties, indeed, a water may contain in solution plant food of the utmost value. As before noticed the principal rivers in Coimbatore rise in the ranges of mountains which border the district and, as these mountains are formed chiefly of primary rocks in which potash-felspar is one of the principal constituents, it is probable that the rain water in passing over and through these rocks, may take up potash and carry it down into the streams below; and, in this way, the irrigation water may contain a considerable quantity of potash, a mineral, which enters largely in the food of all agricultural crops. Again, a clear water may contain a large quantity of carbonic acid gas, and this is the case, especially with the water of jungle streams which rise in and flow through land covered closely with rank growing vegetation. We know that, the Coimbatore rivers obtain their water chiefly from such jungle streams and, we may reasonably take it for granted that, their waters do contain a large precentage of carbonic acid gas. The great solvent properties of carbonic acid gas are well known; when carried into the soil by the irrigation water, it acts upon and sets free large quantities of previously inert plant food, and in this way contributes to the production of a good crop. Of course, there is a wide difference between the action of an irrigation water containing potash and, that of one containing only carbonic acid; the former supplies directly the material which aids in the production of the crop, the latter merely stimulates into activity the plant food previously in the soil, hence a piece of land irrigated by the former water may be maintained in a fertile state for years, while land irrigated by the latter becomes gradually poorer and poorer as each successive crop is removed. But, a water may contain no appreciable quantity of either potash or carbonic acid, and yet, it may produce good effects when used in irrigation. Air is almost as necessary as water for the healthy growth of the roots of most plants; when irrigation water is properly applied that is, when it filters down through the soil, it carries with it a large quantity of atmospheric air, the oxygen of which, acts on the previously inert plant food and brings it into activity, in much the same way as carbonic acid.

My own impression is, that the good effect produced by the irrigation waters of this district is primarily due to the silt deposited on the irrigated land, at certain seasons of the year; for, I made frequent inquiries when visiting this land regarding the yield of the crops it now produces, and, the yield of those it produced twenty or, thirty years ago, and, the invariable reply I received was, that the crops now produced yield quite as satisfactorily as those grown on the land twenty or thirty years ago. Now, if the good effect of the irrigation water was due only to the solvent action of carbonic acid, or oxygen, the water might contain, it is clear that, the soil would have become less productive year by year as the plant food in the soil was used up by the successive crops.

I have said that in this district good crops of paddy might be raised by one-third or at the most one-half of the quantity of water now usually employed provided, *the ryot manured and tilled his soil properly*. If, the irrigation effects are due chiefly to the action of silt, it is clear that, the less water the ryot uses the less silt will his land get; from the ryots point of view then, with such water, it is desirable to employ as much as can be obtained; but, the question assumes altogether a different aspect when viewed from the stand-point of the State, which, supplies the water, and which, has 90 per cent. of its land altogether without water. In this country where irrigation water is so invaluable, and where in some seasons, from its absence, so much land is unproductive, it is I think, a serious mistake to allow irrigation water to be used so lavishly merely that, *the ryot may thereby be saved the trouble and expense of properly tilling and manuring his irrigated land*. If, the State, in order to provide manure for the land of the ryot is obliged to supply twice as much water as is absolutely necessary, it is clear that it is providing the manurial matters at a most excessive cost.

To produce an acre of paddy, as I have already shown, a volume of water is required of one acre in extent and, twelve feet deep or about 3,267,000 gallons; estimating that each gallon contains ten grains of suspended silty matter, capable of being deposited on the irrigated land this would represent a dressing of silt, at the rate of about two tons or about six cart-loads per acre, a very liberal manuring for a crop of paddy.

The water of the Calingaroyen channel after a drought of several months' duration was found, by Mr. Charles Benson, M.R.A.C., to contain three grains of silt per gallon. He examined two samples of the water, one from near the head of the channel and the other from the portion of the channel near Erode; the former contained only three grains of silt per gallon while, the latter which was taken at a place about ten miles lower down the channel contained five grains per gallon. This extraordinary result was afterwards explained, by the fact that the sample, from near the head of the channel was taken one day earlier than the other sample, and that there was in the interval, a fall of rain amounting to ·27 inches. If, such a slight fall of rain as ·27 inches will add two grains of silt per gallon to the water, it will readily be understood that during the monsoon rains, when the paddy crops are being irrigated, a very large quantity of silt must be in suspension in the irrigation water.

Of course, if only half the usual quantity of water was used, there would be a loss in the year, for each acre cropped with paddy of one ton of silt which would have to be made good from other sources if, the ryot would keep up the fertility of his soil.

The ryots who hold river irrigated land are generally in some superior circumstances to those who rent dry land only; their dwelling are much more substantial and roomy, and the people seem to be in comfortable circumstances. I was sorry, however to observe that these ryots, who might be expected to be better farmers than their poorer brethern, practised a system of husbandry in no way superior to that followed by the poorest ryot in the district. The very circumstances which have tended to raise these men a little higher in the social scale, than the poorer cultivators of dry land, have tended to produce results antagonistic to improved farming; for in most instances they, instead of cultivating the land themselves, sublet it under an agreement for one or more years to under-tenants, who rarely possess any capital excepting sometimes what is represented by two or three pairs of wretched undersized plough cattle. In different parts of the district, there is a difference in the terms stipulated for tenancy; in some places the sub-tenant finds the working cattle does the whole of the labour from seed-sowing until thrashing, supplies the seed, and such manure as is used and, in return, he receives of the produce from one-tenth to one-third of the grain, according to the productiveness of the land, and one-half of the straw; the ryot, of course, pays the Government rent out of his share; when, the ryot finds the plough cattle he takes the whole of the straw and, when he finds the seed, he takes half of the straw. Very frequently the sub-tenant stipulates to give a fixed quantity of clean paddy, for each acre of ground he rents from the ryot. As, in most of these instances the sub-tenant's interest in the land ceases after the removal of the crop, it is not likely that he will do anything by adopting superior culture or, by using manure, to improve the condition of the land.

The position of most of these sub-tenants is extremely bad; in a good season they but just manage to comply with the conditions under which they hold the land but, in most seasons they are unable, from the produce of the land, to pay to the ryot, the stipulated quantity of grain, and to repay him along with the interest, the advances of grain received for their daily support during the growth of the crop. The consequence is that, most of these sub-tenants are deeply involved in debt to the ryot, and are practically his serfs. The ryot, in dealing with his sub-tenants, exacts fully the terms agreed upon; if, the crop does not return as much grain as the sub-tenant promised to pay, the ryot takes the whole crop, and the balance remaining stands to the debit of the sub-tenant at a fixed rate of interest, in grain.

As before noticed, good crops are produced on much of this river-irrigated land but, this is due entirely to the peculiarly favorable conditions met with on such land. I saw land which was said to produce annually in an average season in two crops from 1,200 to 1,300 Madras measures of paddy, without the aid of any manure excepting three or four cart-loads of the green plant of mudder or wild indigo. But, the water expended on an acre of land in producing such crops would, under good management, have sufficed for the requirements of four or five acres of wheat or maize, one acre of which would have yielded as much human food as the acre of paddy.

The right-of-occupation of much of this river-watered land now commands a high price, sometimes as much as from 200 to 250 rupees per acre; while, that of much of the adjoining dry land would not fetch more than 8 or 10 rupees per acre. I was shown some irrigated land for which twenty years ago the right-of-occupation was considered to be worth only 50 rupees per acre, but which now is valued at 200 rupees per acre; this great increase in value was not due to any improvements having been effected by the lessee or *putta*-holder during those twenty years but, to the largely increased money returns now realized from such land. When the ryot has, at much personal labor, or expense, converted dry land into irrigatable land, by altering its surface and laying it out in terraces, he has, of course, perfect right, when transferring his holding to an incoming tenant, to demand the full value of the improvements effected; but, when the increased value is due to causes over which he has no control, the State should, I think, share in the larger returns. In most instances, the present high value of the right-of-occupation of this land is not due to any improvements effected by the occupying tenant or, by any of his predecessors but, to the great increase in the population, and, the consequent increased local value of agricultural produce. When the right-of-occupation of irrigated land, situated in ordinary agricultural localities, commands rates out of all proportion to what would represent a fair return on the capital originally sunk, in converting the land into irrigatable land, it is clear that the rent paid by such land must be *very moderate*. In many places the annual Government rent for such land is about 9 rupees, per acre, for one crop, and 12 or 13 rupees per acre, for two crops; if such land will yield in two crops say, 1,000 Madras measures worth 50 rupees, the net return to the ryot is a very handsome one.

THE FARMING OF THE LAND IRRIGATED FROM WELLS.

In 1871-72 there were in the Coimbatore district 57,137 wells, of which 49,222 were in good repair and, in full use: assuming that there are, now in the district, 50,000 wells each capable of watering 3 acres of land, there will be altogether 150,000 acres irrigated from wells.

The wells are met with chiefly in the neighbourhood of the large towns and villages. From the presence of these wells, the outskrits of many of the towns present a very different appearance to what is seen further out in the district. From conversations with ryots regarding well-sinking, I learnt that, many of them would attempt to sink wells if, there was any certainty of meeting with water at a moderate depth, without the necessity of cutting through hard rock. I was shown several places where ryots had gone to much expense in attempting to sink wells and had failed. Well-sinking as conducted by the ryot is attended with great uncertainty and as, the wells cost frequently from 150 to 300 rupees, it will readily be understood that after half completing a well and expending a sum equal to, say, one-half of its estimated cost, it is a very serious matter to a ryot, to have to abandon the work. Of course, the greatest uncertainty attends the sinking of the first well in a locality, and, there are but few cultivators willing to encounter the risk. In tracts of country suited for wells, but which are yet without them, Government might, I think, set the example in well-sinking; if successful, the probability is that the ryots would follow the example and sink other wells in the locality, and in this way the general revenue of the district would be made more certain. To meet the interest on capital outlayed in sinking these wells, a water rate might be charged on the land watered from them.

I was surprised to find so little known regarding the Land Improvement Act under which, ryots could so readily obtain money, on reasonable terms, for use in sinking wells. I informed many of the ryots the terms under which they could, under this Act, obtain money for well-sinking, and they generally expressed their readiness to sink wells if, provided with money in accordance with the terms of the Act. Some considered that there should be a provision in the Act, under which the outlay should not be chargeable against the ryot when the further sinking of a well had to be abandoned, from hard rock being met with or, from the water-bearing strata being found too far down. They said that it would be a great hardship if, a man borrowed, say 200 rupees from Government and after expending half of the amount, in an unsuccessful attempt in well-sinking that, he should be called upon to make good the loss. I explained to them that if, in the place where it was proposed to sink a well, a well-auger was first used, to test the depth of the water-bearing strata and, the nature of the rock overlying it, there would be but little risk in sinking the well but they still contended that, Government should bear the loss when, the sinking of a well had to be abandoned. Of course, there will always be some amount of risk attending the sinking of a well, but if, the ryot makes the attempt, in the place pointed out to him by an Officer of Government, appointed for the purpose, and, it becomes necessary for any reason to abandon the work before completion, I think that, the ryot should not bear the loss. It would only be in rare instances if proper precautions were taken, that, it would be necessary to abandon the work when only partially completed, and, such losses might be recovered by the State, by slightly increasing the interest chargeable on money advanced for well-sinking.

There is I think but little probability of there being a large increase in the number of wells in this district as long as the sinking of a well is attended with a risk such as will frequently represent the loss of a sum, equal to a whole year's income of a ryot; and, a half, or, even, 1 per cent. added to the rate of interest chargeable for money advanced by the State, under the Land Improvement Act would be no hinderance whatever, to those desirous of sinking wells. Of course, in parts of the country where there are already many wells, great caution would have to be exercised in increasing their number or, injury may be done to those already existing from their water supply being lessened.

There are considerable tracts of country yet without wells, in all parts of the district, in which wells might be sunk, and where subterranean water is as likely to be met with quite as near to the surface, and in as large quantities as in other parts of the country where there are wells. Superstition guides the Coimbatore cultivator in the choice of a site for a well; generally, he procures a sheep and, drives it to the land in which he desires to sink a well; he then pours some water over the head of the animal and sets it at liberty, it wanders over the ground and, the spot of land over which it shakes its head, to get rid of the moisture, is the place in which the well must be sunk. I could never get from any ryot any satisfactory explanation of the reason they had in following this ridiculous practice, they admitted when pressed, that the result of sinking wells in sites so selected, was often highly unsatisfactory. The prevalence of this superstitious custom shows what uncertainties attend well-sinking in this district for, the men who follow this practice frequently possess a good deal of common sense in regard to matters which daily occupy their time and attention. They select their site for the well in much the same way as men in other countries decide a course of action on the result of the throw of a coin. However the Coimbatore custom is quite as sensible as the practice adopted in other countries when, the divining-rod is used in the search for water. It is highly unsatisfactory, that an improvement such as the sinking of a well, should be attended with such uncertainties when, it is in the power of the State, at a very trifling expense, to do away with many of these uncertainties. The ryots when told that it was possible to bore down through the ground by means of an auger to the water bearing strata, were much delighted, and, expressed their great desire that each *taluq* should be provided with one or two of these augers, I would strongly advise, that, a couple of augers should be obtained for use in the Coimbatore *taluq* in the first instance, they should, I think, be placed in the charge of an intelligent Overseer of the Public Works Department, after a little practice, under different conditions he would be able to select the most suitable places for boring for water, which places might be marked by a stone and, the exact position noted on the village map, with information, showing the nature of the strata passed through and, the depth at which water was found. After such experimental tests had been made, the ryots might sink the wells at any time, when most convenient, when labor and money are available.

Throughout the district cattle-power is everywhere employed for raising water from wells. The water is lifted from a well in a skin bucket, to the bucket is attached a rope which, at its other end, is fixed to the yoke of a pair of cattle; a roller or pulley is fixed about 4 or 5 feet higher than the discharging trough and, slightly over the well, over this roller pully, the rope travels as the bucket ascends or descends. The bullock path is a very steep incline. When raisingthe bucket the cattle walk down the sloping path until the bucket reaches the full height and charges its contents when, the cattle are again backed up the slope, and the bucket again sinks into the water, to be again raised by the forward motion of the cattle, and thus the process is again and again repeated. This arrangement is certainly very simple, however the cost of raising the water is very great. From experiments I made during my tour, and from the information I then gathered, I find that, when the water is to be raised about 20 feet, it costs the ryot 2 rupees for watering an acre of ground once, with an application of water equal to about 23,000 gallons, which is an average watering and equal to a rainfall of about one inch.

As, an ordinary crop of cumboo, cholum, or, raggy, receives during growth on the average, from 10 to 12 waterings it will be seen that the water costs the ryot from rupees 20 to rupees 24 for each acre, of any one of these crops he produces on land irrigated from a well.

The following shows the cost of raising water from a well of average depth, by the water-raising arrangement just noticed ;—

Depth of the water below the surface of the ground ...	20 feet.
Cost of the pair of cattle required.	40 rupees.
Cost of earthwork, cistern, and woodwork	20 ,,
Cost of skin-bucket and rope	6 ,,
Duration of skin-bucket and rope...	3 months.
Buckets emptied per hour	65 No.
Contents of the bucket at the point of discharge	20 gallons.
Time occupied by the cattle in going down the slope	10 to 15 seconds.
Time occupied by the cattle in backing up the slope and making ready for return journey	45 seconds.
Day's work	6 hours.
Daily pay of driver	2 annas.
Daily pay of water-distributer	1½ ,,
Daily hire of cattle (when hired)	6 ,,

The cost per day will be as below :—

	Rs.	A.	P.
Hire of cattle	0	6	0
Hire of driver	0	2	0
Hire of water-distributer...	0	1	6
Interest and wear and tear, at 10 per cent., per annum, on the capital invested, rupees 66, charged over 250 working days in the year	0	0	5
Cost of replacing buckets and ropes, once in 5 months, charged over 250 working days in the year	0	1	2
Total ...	0	11	1

It takes on the average 3 days' full work to water 1 acre of land, the cost per acre is thus rupees 2-1-3. When the ryot employs his own cattle, which is the usual practice, and, drives them himself which is also usual, the actual outlay, of course, will be less but, the amount saved, will be but a poor return to the ryot for his labor and, the labor of his cattle ; and, it must be remembered that, as the work is severe, the cattle do not last long and, require to be replaced at, sometimes very short intervals. The expenses cannot therefore be put at less than the sum I have mentioned. The working hours are generally from 7 A.M. to 10 A.M. and from 3 P.M. to 6 P.M. daily, that is 6 hours in all. Assuming that, the work throughout the working hours is performed in a regular way, and that 65 buckets, each containing 20 gallons, are raised per hour, the total quantity raised during a day will be 7,800 gallons, at a cost of annas 11 pie 1 or, about 11,260 gallons for one rupee. This may be accepted as the average cost incurred for raising water from wells ; the wells, are in some places from 30 to 40 feet in depth, but in other places, they are only from 12 to 15 feet deep and, I think that, there are many more wells under 20 feet in depth than there are of a depth greater than 20 feet, There is in different parts of the district a considerable variation in the size of the buckets used ; I measured some buckets that could contain only 10 gallons of water and, I measured others that would contain 25 gallons at the least.

I was glad to see in the town of Coimbatore, 8 improved water-lifts at work, all of the kind known as the "Double Mhote"; they were made from a model supplied by the Sydapet Experimental Farm. I learn that there is every prospect that this improved water-lift will be adopted in this district. The experience gained with the lift by the Coimbatore Municipality, has been of the most satisfactory character, the lift raises, when worked by one bullock, as much water as was formerly raised by two of the ordinary water-lifts, each worked by a pair of bullocks.

The following shows the capabilities of one of these improved water-lifts ; the working data was obtained from the experiments made at Sydapet ; but the calculations are based on the rate of wages, cost of materials, working hours, &c., prevalent in the Coimbatore District :—

Depth of the water below the surface of the ground	20 feet.
Cost of the bullock required	53 rupees.
Cost of timber, bricks, lime and labor	100 ,,
Cost of the 2 skin buckets and two ropes	15 ,,
Duration of skin buckets and ropes	3 months.
Buckets emptied per hour...	90 No.
Contents of each bucket at the point of discharge	30 gallons.
Day's work	6 hours.
Daily pay of driver	2 annas.
Daily pay of water-distributer	1½ ,,
Daily hire of bullock (when hired)	4 ,,

The cost per day will be as below :—

	Rs.	A.	P.
Hire of bullock	0	4	0
Hire of driver	0	2	0
Hire of water-distributer...	0	1	6
Interest and wear and tear, at 10 per cent., per annum on the capital invested, rupees 150, charged over 250 working days in the year	0	1	0
Cost of replacing the buckets and ropes, 3 times a year, say Rs. 60, charged over 250 working days in the year ...	0	[illegible]	10
Oil, &c., ...	0	0	6
Total ...	0	11	10

The cost per day for working this machine is therefore annas 11 pies 10. When working at the ordinary speed, 90 buckets are raised per hour, and, as each bucket contains 30 gallons when at the point of delivery, the quantity of water raised per hour is 2,700 gallons, or in a day of 6 working hours, the quantity raised is 16,200 gallons. For an expenditure of one rupee, 21,904 gallons of water can be raised to the height of 20 feet by the Improved Lift against, 11,260 gallons, raised for one rupee, by the old-fashioned Lift. To irrigate an acre of land with the quantity of water generally used, the cost will be, by means of the old-fashioned Water-lift, Rs. 2-1-3 or, by the Improved Water-lift Rs. 1-1-1. I have mentioned before that a crop of Raggy, Cumboo, or Cholum, when grown with the aid of well water, receives from 10 to 12 waterings ; the cost then, of the irrigation water for an area of one of those crops will be, when the unimproved Lift is used, Rs. 22-13-9 or, when the Improved Lift is used, Rs. 11-11-11 ; thus, showing a saving of about Rs. 11 per acre ; and, the saving will be greater in the case of many other of the crops raised with water from wells, from the greater quantity of water required. We have, in this district, as before noticed, 150,000 acres of land irrigated from wells, by means of these unimproved Lifts, if then, it is possible to save Rs. 11 on each acre of crop raised, by substituting the Improved Lift for that now in use, a total saving might be effected amountig to, at the least, two million of rupees, per annum, for it must be remembered that, much of the land bears two crops in the year. We often hear of the poverty of the ryot, and yet, we find that, in the district of Coimbatore alone, on the small area irrigated from wells, a saving in the annual expenses of the ryot could be effected, that in the aggregate, *would be nearly equal in amount to the entire annual rent of the district payable to the State.* Water manure, more cattle labor, and more manual labor, are imperatively demanded by 90 per cent. of the cultivated area. By adopting the new Water-lift, the ryot will be able to water double the area he was previously able to irrigate ; if, he prefers not to extend the irrigated area of his holding, he will have cattle labor, and manual labor set free for collecting and bringing manure to his land, and for the more thorough tillage of his soil, &c., &c. Not only is it possible to reduce greatly the cost of lifting water from wells, but, the water after being raised, might be made to go a great deal further than it now does if, proper means were taken. As a general rule the soils of the ryot contain but a very small percentage of organic matter, and, the tendency of his farming is to reduce this small percentage still lower. The action of organic matter (humus) in the soil is well known, it enables the soil to take up moisture from the air and to store up that moisture ready for the use of plants. An application of a quantity of water equal to half an inch of rainfall on a soil containing 5 or 6 per cent. of organic matter, will produce better and more continued effects than a quantity of water equal to 1 inch of rainfall will on a soil containing only 2 or 3 per cent. of organic matter, other conditions being equal. In other words, if the soil was properly manured and tilled, the quantity of water that now suffices only for 3 acres, would suffice for 6 acres. and the effective work of a well would be doubled. There would be no practical difficulty whatever, in increasing largely the organic matter in the soils ; it would only be necessary that the ryot should use farmyard manure in manuring his soil, instead of burning the dung of his cattle or, that he should plough into the soil one or two green crops. The general use of cattle dung as fuel, is the course of Indian agriculture, not only is the soil deprived of so much direct plant food but, the physical conditions of the soil are seriously deteriorated when it is cropped without the aid of organic manure. Mr. Schiffmayer, in his experiments, found that, the soils of the Sydapet Experimental Farm had their powers of absorbing and retaining moisture increased 10 per cent. by the addition of 5 per cent. of organic matter. Much more skill is exhibited by the ryot, in the cultivation of the land irrigated from wells, than in the cultivation of either river irrigated land or, ordinary unirrigated land. The cropping of the land irrigated from wells is very varied. Cholum, cumboo, and raggy occupy the] largest area, in some portions of the district, land irrigated from wells is cropped only with these crops ; as before noticed the ryot recognizes garden varieties of each of these cereals and, as he always sows these varieties on his land that is irrigated from wells, the crops have acquired a habit of early maturity. As a general rule, the crops standing, at the time of my tour, on land irrigated from wells were good as regards, length of straw and uniformity of growth, but the heads or ears, were generally very small and badly filled with grain. Tobacco, is largely grown in this district and it is raised almost exclusively on the land dependant on irrigation from wells. The area annually cropped with tobacco is about 20,000 acres. The crop is grown throughout the district. The climate of Coimbatore is, generally, well suited for the production of tobacco but, it is ill suited for the curing operations. Hence, tobacco grown there, should either be sent to a more genial climate to undergo the curing processes or, it should be cured in factories erected for the purpose in which, the peculiar atmospherical conditions required, may be secured. The late Government Quinologist, J Broughton, Esq., examined, chemically, a number of samples of tobacco, which had been produced in different parts of this district. The following are some of the results obtained ;—

Where grown.	Per cent. of ash.	Per cent. of Carbonate of Potash in ash.	Per cent. of Nicotine.
Coimbatore	22·856	2·94	8·32
Ditto	22·606	5·64	4·95
Ditto	19·928	7·92	4·90
Pollachy	24·987	4·39	1·95
Moocasipoodoor	25·78	7·67	2·24
Coorchy	26·30	7 93	1·17
Pondoray Semoor	23·34	2·65	1 29
Aval	23·19	19·97	1 46
Monigumpolium	26·65	2·61	2·95
Madhaliy	23·45	5·33	2·82
Sattiamungalum (A)	17·09	14·74	2·68
Ditto (B)	21·34	8·87	2·74
Ditto (C)	25·14	9·14	3·92

It will be observed that the percentage of carbonate of potash, found in the ash of the tobaccos, varied very considerably; and, it is, it must be remembered, upon the presence of this salt, in the tobacco, in a sufficient quantity that, its proper burning so greatly depends. Mr. Broughton also examined a sample of Havanna and of Mannila tobacco which, had been produced in the district, the result was as follows:—

Variety.	Per cent. of ash	Per cent of Carbonate of Potash in ash.
Havanna	22·55	6·18
Mannila	23·25	10 25

The tobaccos contained only a very small percentage of nicotine and their flavours were considered by Mr Broughton to be very good With reference to these tobaccos, he wrote in his report —" I consider that these samples show that foreign tobaccos, if grown in suitable localities in South India can be produced of their foreign quality. The Mannila tobacco, if it had been cured with care by a European or instructed Native would I am convinced, have possessed the high qualities of foreign Mannila tobacco" These samples were produced in the Erode *taluq* on an ordinary red soil, the best tobaccos are said to be produced in the *taluqs* of Coimbatore, Erode and Sattiamungalum I saw tobacco growing in all the *taluqs* I visited and, observed good crops, and indifferent crops growing in all. However, the market value of the tobacco produced in the southern *taluqs* is never so high as that of the tobaccos of the northern *taluqs* If, ever the production and manufacture of tobacco becomes a Government monopoly in this Presidency, the district of Coimbatore would offer great facilities for the production of tobacco on a large scale. There are good tobacco soils in all the *taluqs* but, the *taluq* of Sattiamungalum would, I think, afford the best soils and the most favourable climate for the curing operations

It is said that the red soils produce the best qualities of tobacco and, I should certainly prefer these soils as, they are generally more friable and porous and, do not bake and contract during a slight drought to the same extent as do the black soils. The season in which tobacco is sown varies in different parts of the district but, generally, August and September is the sowing season The seed is usually sown in nursery beds and the young seedlings are transplanted out into the field when from 6 weeks to two months old There is nothing worth special notice in the tobacco cultivation of this district Ryots always endeavour to put their tobacco land in a good manural condition, they fully recognize the exhausting nature of the crop and, the demand it makes upon the soil Tobacco land is usually manured, by folding sheep upon it, and occasionally by dressings with the village ashes Tobacco land usually bears a crop of raggy in addition to the tobacco during the year. The harvest season for tobacco, varies of course with the sowing seasons but over the district generally, the tobacco harvest is in the months of February, March and April. There is perhaps no crop grown by the ryot which indicates more accurately the condition of the soil and, the character of the cultivation, than does a tobacco crop It was not unusual in going through the district to observe, almost side by side, crops that would, probably, not yield 100lbs of tobacco, per acre and others, that might fairly be expected to yield from 750 to 1000lbs per acre, on soils apparently of the same class The tobacco crop from the cost of the waterings it receives, is an expensive one, however, the returns are good, under satisfactory conditions. A crop of 750lbs, which may be taken as an average one on fairly farmed land, will realize from Rs 60 to 65, that is after the leaf has been prepared for the market, and, this, after paying the ryot for the labor of himself and his cattle and, for such occasional labor as he may employ, towards the payment of the rent of the holding I saw some very well grown tobacco in different parts of the district but, everywhere, the cured tobacco was inferior. The advantages the district possesses for the production of the tobacco plant, are nearly altogether lost, from the treatment the leaf receives after leaving the field The curing process is almost exactly the same as that followed all over the Presidency. There is I think no probability that a good marketable tobacco will be produced in this district as long as the curing is in the hands of the ryot. It is quite impossible that the ryot, with the very limited means at his disposal, can produce a sample of tobacco that can, at all, approach in appearance or condition, the tobacco produced by the skilled agency and elaborate appliances, employed in other countries. In many parts of Coimbatore, the curing of the tobacco produced, would give ample employment to a factory and, several of these might I think, be started with advantage It is obvious that, if the curing operations of the factory began with the green leaf when newly harvested that, the area of country from which the tobacco could be received, would be much more limited, than if, the factory began operations on half cured tobacco. The green leaf would not bear distant carriage, it is so liable to heat when full of sap, on the other hand, the quality of a tobacco depends very largely upon the skill with which it has been treated in the early processes of curing. Nearly all the tobacco, raised in this district, is cured under the verandahs of the ryots' dwellings, or, inside their dwellings Sheds are never erected purposely in which to cure tobacco. The first stages of the curing are performed chiefly out-of-doors, the leaves being suspended in various ways while drying. I saw in some places, rows of castor oil plants, supporting lines over which tobacco leaves were *suspended. Much of the tobacco produced is sent to Malabar It is said that, a quantity of the Coimbatore tobacco is also forwarded to Trichinopoly where, it is used up with the tobacco produced there. Coimbatore tobacco sells for, when cured from Rs. 5 to 1[illegible] per 100lbs. There can be no doubt but that, tobacco culture could be largely extended in this district; the climate is favourable for the growth of the crop, there are large areas of land suited for the growth of tobacco, and special food of the tobacco, potash, is available in large quantities in the shape of saltpetre which is produced to a very considerable extent in many places One serious defect, universal in the tobaccos of Southern India, arises from the deficiency of potash in the soils on which they are grown, this deficiency could be remedied to a certain extent, by using saltpetre as a manure this, on decomposition would afford nitric acid and potash, foods which are so largely consumed by the tobacco plant, when growing under favourable conditions

Chillies occupy about 15,000 acres of land in the year. They are grown principally in the Pollachy and Erode *taluqs* The produce is consumed chiefly within the district. The crops that I saw were generally good The return from one acre of land under chillies is very much less than the return from one acre under tobacco but, on the other hand the expenses attending raising of a crop of chillies, are much smaller both in the field and, in preparation for the market.

Sugarcane occupies about 3,000 acres of the area annually under crop, and fully one-third of the area is in the Coimbatore *taluq*. The crops of sugarcane that I observed were very good and apparently well cultivated. The cane is usually milled where it is grown and, the juice made into jaggery The process is rude and wasteful I was shown some crops from which, a yield of about 100 maunds of jaggery, per acre was expected, worth about one rupee, per maund Land intended for sugarcane is always well manured if the ryot can get this without much trouble. Certain land is regularly cropped every second year with sugarcane, such land is said to have diminished in yield, during the last 30 years from 120 maunds down to 80 maunds of jaggery, per acre Sugarcane is an expensive crop to grow, when the water has to be raised to a considerable height as it is usually watered every third day, and is on the ground for about a year, still the ryot who grows it, is afforded regular employment for himself and for his cattle, for which services, he obtains reasonable compensation in the returns realized when the crop is sold. Seeing that, the district offers so many facilities in its climate and soils for the production of sugar, it is to be regretted that such a small area is cropped with the sugarcane Under a good system of farming, there would be no great difficulty in increasing the area very largely But, before the ryot can enter more largely upon the cultivation of sugarcane he must adopt a more rational system of agriculture. Sugarcane cannot be produced under the "starvation system" which characterizes the ryots' treatment of land, manure and thorough tillage are required in order to secure fair results The fact that while this district offers many facilities for the production of sugarcane, it produces in the year, only 3 000 acres on its 2 200,000 acres of occupied land, shows, how low is the agricultural practice. In the sugarcane the ryot possesses a crop which will, under fair average conditions, bring in a gross return of Rs 80 to 100 per acre, and yet, he occupies 95 per cent. of his cultivatable land with crops that do not bring in a gross return of Rs 1[illegible] per acre

The area annually, under wheat is only about 2,500 acres and, nearly the whole is produced in the Coimbatore *taluq* The variety cultivated is *Triticum Spelta* It is a bearded wheat and its grain is covered by an adherent husk. The crop is sown during November and December and is reaped in February and March Wheat is always irrigated from wells, generally, about four times a month Coimbatore wheat is highly appreciated for its bread producing capabilities The large European population on the Neilgherries is supported almost entirely on wheat obtained from the Coimbatore district Its grain is admirably suited for making *rolong* with which the bread used by Europeans in this country, is chiefly made The grain is hard and gritty and, does not make a good flour, hence the the common practice of making *rolong* from it The wheat plant is very short, and the ear is small The yield, of an average crop, is said to be about 400lbs per acre, that is of grain-in-the-husk There would be no difficulty whatever in increasing largely the production of wheat in this district provided a better agricultural practice prevailed There is a considerable demand, in southern India for wheat, at remunerative prices and, there are abundant facilities in the Coimbatore district for producing wheat on a large scale All that is required is a better system of agriculture, in which the soil will not be starved but maintained in a good fertile state There is some need for the introduction of fresh seed and, there would, I think, be no difficulty in obtaining from Egypt or, from Southern Europe a variety suited to the Coimbatore climate.

Plantains, saffron, sweet potatoes coriander seed onions &c., occupy the remainder of the land irrigated from wells but the area under each of these crops is small

As before noticed the farming of the land irrigated from wells, is superior to the farming of the district generally Irrigation water is more carefully used by the ryot when he has had to raise it to a considerable height he then appreciates more fully its value, and accordingly uses it with care During my whole tour I do not remember ever having seen any land that was swamped by well water, in the way that is so common when the water used, is supplied from a tank of a channel by gravitation If, the users of irrigation water, supplied by gravitation, could be induced or compelled, to use it with the same economy that is practised in dealing with the water raised from a well, the state of the country would be very different to what it now is

If a wheat crop, can be raised in the district with a quantity of water equal to about a rainfall of 16 inches, there is surely something very wrong when the ryot is permitted to use in raising a crop of paddy, a quantity of water equal to a rainfall of 144 inches. There can be no doubt but that, an acre of land will, under wheat, produce as much human nutriment as an acre of land under rice The water of some wells contains mineral food in solution and when such water is used, its influence is greater than that of pure water, however I do not think that, the fertility produced on the land irrigated from wells, is due to any extent to the soluble plant food contained in the water, for, the ryots generally agreed in stating that, their "garden land" which is the land watered from wells, is not productive unless manured The active growth of crops on land irrigated from wells is due, I think, to the plant food being prepared and maintained in a form easy of assimilation by the growing plant, and, to the energies of the plant being stimulated by the favorable physical conditions under which it is growing, the carbonic acid, and oxygen brought in the irrigation water playing an important part in the conversion to an assimilable form, of the raw plant food in the manure applied and, in rendering active, the previously dormant food in the soil itself. Almost the whole of the manure the ryot ever uses is expended on the land irrigated from wells. It consists chiefly of village ashes, and weathered sun-dried cattle dung but, the general practice in manuring this description of land, is to fold sheep on it during night, the animals being allowed during the day to graze elsewhere. The efficacy of the practice depending upon the quantity of excreta, solid and liquid, deposited on the land by the sheep during the night. The practice of sheep-folding is a good one but, in the hands of the ryot it is not sufficiently developed. It is clear that, there can be no increase in the manural constituents of an arable soil, from the deposit on it of the solid, and liquid excreta of sheep, that depended for food entirely on the wild scanty vegetation produced on the soil during the dry season. Yet, the efficacy of sheep-folding as a means of fertilizing a soil, is universally admitted. However, in all civilized countries, when sheep are folded on land, they are provided on the land itself, with green crops, produced by the aid of manure, and, the sheep receive, in addition, a daily allowance of oil-cake, pulse, or grain, hence the higher fertilizing value of their excrement. As sheep-folding is conducted on land in this district there is but a slight increase in manural matters; the chief good, resulting from the plant food being left in a form easily of assimilation by growing crops. Sometimes, land irrigated from wells is sub-let but, this is far from being the usual practice. When sub-let, the sub tenant pays the ryot or *puttah*-holder one-fourth to one-third of the grain the land produces, the cultivating tenant retaining the remainder of the grain and the whole of the straw. Under such an arrangement, the cultivating tenant provides at his own expense the cattle, seeds, manure, labor, water buckets, &c., &c., the Government rent is paid by the ryot, who holds the *puttah* or lease. When the ryot finds the cattle, he usually gets one-half of the grain and one-half of the straw. I have referred very briefly to the manuring of the land irrigated from wells as, I intend, when referring to the cultivation of the unirrigated land, to discuss the subject of manures more fully.

(To be continued.)

SORGHUM SACCHARATUM.

(MR. F. G. WIGLEY'S REPORT.)

THE great want of good, succulent fodder grasses in India, is a subject that has frequently engaged the attention of the Government of this country. The chief causes of insufficiency of pasture are want of moisture, want of manure, a bad system of agriculture, and the general carelessness of the native cultivators in everything relating to the well being of their stock, Indian cultivators being proverbially neglectful of their beasts, although they are their main resource. Various attempts have, from time to time, been made to improve this state of things, either by the experimental cultivation under a better system of agriculture of indigenous fodder plants, or by the introduction from other countries of fodder-yielding plants and grasses which there has been reason to believe would thrive in India. Among the best of these, sorgho, the Northern Chinese sugarcane, takes prominent rank. This plant, as its name indicates, is a native of the north of China, and among its popular names are "sorgho," "sorghum," "sorgho sucre," "Chinese sugarcane," and "imphee." It is of the Natural order named *Holcus saccharatus* and *Sorghum saccharatum*. There are several species of *sorghum* cultivated in India. They are—

(1) The *Sorghum vulgare* synonyms, *Holcus sorghum*, *Holcus durra*, and *Andropogon sorghum*, the produce of which is called 'jowar' or "janeora" in Bengal, and 'cholum' and 'jonna" in the Madras Presidency. This jowar, which is known as the "Great Indian Millet," is also extensively cultivated in other parts of Asia and in the West Indies, and indeed it is grown in almost all tropical countries.

(2.) *Sorghum halepense*, the synonyms of which are *Holcus cernuus* and *Andropogon cernuus*, known as the "shaloo" of the Deccan, and grown in the Broach districts of the Bombay Presidency under the name of "Soondia."

(3.) *Holcus bicolor* syn. *Andropogon bicolor*, known as the "black deodhan" or "black jowar."

(4) The *Andropogon saccharatus* of Roxburgh, known as the "white "deodhan" of Bengal. Dr. Roxburgh was uncertain whether this was the *Holcus saccharatus* of Linnæus, and Mr. John Scott, Curator of the Royal Botanical Gardens at Calcutta, who wrote a memorandum on the *Sorghum saccharatum* and *Sorghum vulgare*, thought that the "White Deodhan' was merely a variety of the *Sorghum vulgare* Pers., and not a distinct species at all.

From experiments made in India, it has been proved that the Sorgho (*Sorghum saccharatum*) which has been so long under cultivation in China is a much finer plant than the most common and best in this country of the cultivated varieties of the *Sorghum vulgare*, *viz*, the jowar; growing to a much greater height, containing much more saccharine matter in the stem, and, possessing the faculty of rattooning, giving three or more cuttings in one season from one sowing, while more than one cutting is not ordinarily obtainable from the jowar. The experiments made in India with sorgho have been undertaken chiefly with a view to compare its value with that of the [illegible] which is so extensively cultivated throughout the country for grain and forage; and it will be one of the objects of this note to show from these experiments the value of sorgho in comparison with the jowar, and to consider how far it is likely to replace that plant in th[illegible] ation of those who cultivate it for forage.

The first introduction of sorgho into India dates as far back as the year 1858, when the Madras Government, at the instance of Dr. Balfour who was then in charge of the Government Central Museum, obtained a supply of imphee seed from the Cape of Good Hope, and also a small quantity of seed of the Chinese sorgho from America. This seed was very widely distributed amongst the several agricultural societies, to district officers and others, all over India, as well as to a few private gentlemen in the Madras Presidency, for experiment with a view to determine the value of the sorgho both as a sugar and forage plant.

The results of these first experiments were various in different parts of the country, but tended generally to shew that wherever the seed was good when it was sown, and proper care was exercised as to the time of sowing, the plants would grow well and the crop prove a profitable one; and the general opinion formed of sorgho was, that although it was not to be compared with the ordinary sugarcane of the country as a sugar producer, it would prove valuable as a forage plant.

In the Madras Presidency the experiments,—which were chiefly with the African imphee,—were continued up to the end of year 1863, and good results, several experiments being made at different seasons in each district of the Presidency, when the conclusion arrived at by the Board of Revenue at Madras was as follows:—

"The cultivation of imphee in this country is no longer a doubtful experiment. The plant grows freely whenever cultivated with ordinary judgment and care. It certainly will not take the place of sugar cane and it may be doubted whether it will pay as an irrigated crop, but it affords excellent forage for horses and cattle, and may be cut three times for each sowing. It is of rapid growth, and should be sown in the first rains, so that the third growth may derive advantage from the latest rains, and a good seed be obtained for resowing."

And further, on some later failures to make sugar from the juice being reported, that "the value of the plant is as fodder for cattle, or as a cereal; that it is a mistake to suppose that it is valuable as a sugar-producing plant; and that without attaching any very great value to the imphee plant in the Madras Presidency, except for forage, the Board see no reason whatever to suppose that it will not grow well in every district it fairly tried."

The experiments at this point seem to have been given up entirely. They were only made at the instance of the Government, and the natives generally after making them, and seeing the good results obtained by European experimentors, paid no further attention to the plant. It was reported from one of the Madras districts (Coimbatore), that the imphee had, with the exception of the head, very much the same appearance as the cholum (jowar) which is so extensively cultivated in the Presidency, and that it was considered by the ryots to be a variety of cholum, and was called by them "sugar-cholum." Reports of a similar character were received from other districts and it was thought that these facts would favour the introduction of the imphee into the Madras Presidency, but the natives still continued to cultivate their cholum for forage in preference to it, notwithstanding that the imphee was proved to be so valuable as a forage crop. The general inferiority of the imphee as a grain-yielder had apparently something to do with this, the ryots getting both grain and fodder in tolerable quantities from the cholum, while with the imphee, a large yield of fodder is usually accompanied by a small yield of grain. Some private gentlemen who made experiments with the imphee, and who too[illegible] especial interest in the cultivation of the plant, formed a high opinion of it. One of these gentlemen, Mr. Kohloff, to whose opinion much weight was attached, thought that the imphee would be likely to thrive in the Tanjore district, where he cultivated it, and that it would be a valuable addition to its cereals, as, unlike the cholum it throws out several ears at a time and yields a second crop. He added that the stalks of the imphee were not so dry and hard as those of the cholum and that bullocks that were accustomed to be fed with straw ate them with avidity, while they refused cholum stalks.

The Agri Horticultural Society at Madras has been regularly importing seed of Chinese sorgho since 1858, the year of the introduction of the plant, and sorgho has been under cultivation in the Presidency to a small extent ever since, but since the cessation in 1863 of the special experiments conducted by direction of the Government, the only regular experiments made appear to have been those at the Government farms. Some interesting experiments with the Chinese sorgho have been made on the Sydapet farms, which prove the value of this plant both as a forage and grain yielder. The first of these experiments was made in 1870, when the value of sorgho under different kinds of manure was tested. Mr. W. R. Robertson, the Superintendent of the farm, reported on this experiment as follows:—

"*Chinese sugar cane.*—This is the true *sorghum saccharatum*; it is a millet, and in habit of growth and in general appearance resembles cholum of this country. The seed was obtained from Sydney. The soil having been cultivated as for cholum, was sown on the 10th October 1870. The total area of the piece of land selected was 3,481 yards and the seed used weighed ten pounds. The seed was sown in drills about two feet apart; it germinated very slowly, and took at least double the time required by cholum in coming through the ground. However, the crop was regular and the plants healthy. When about four inches in height a portion of ground was divided into plots, each containing one-eighteenth of an acre, and different manural top-dressings were applied. The Peruvian guano used was an inferior sample; it contained a very small percentage of ammoniacal salts. The other manures were such as are procurable in this district, and the prices charged are the prices actually paid. The carbonate of lime was powdered shell chunam. All the applications were reduced to a powder before being used; they were all mixed with sand, in order that they should be equally distributed over the ground. A quiet morning was selected for sowing the manure; a drill cultivator followed immediately behind the sower and covered the manure. The crop was grown entirely under dry cultivation; it grew well and had at all times a promising appearance.

"The drill cultivator was passed two or three times through the crop during its early growth, and this was all the cultivation it received.

"In their early growth the canes contained very little more sugar than ordinary cholum. The quantity of saccharine matter was greatest at the time when the seed began to harden. It is at this stage that it is usual in America to cut down the crop for the purpose of extracting the sugar. Harvesting commenced on the 25th January."

The ground on which this experiment was made was divided into twelve plots, two being unmanured, and the other ten manured with five different kinds of manure, each manure being applied to two different plots. The following is an abstract of the results obtained :—

Average results on one-eighteenth of an acre.

MANURE.	YIELD.				INCREASE DUE TO MANURE.			
	Grain.		Straw.		Grain.		Straw.	
	lbs.	per acre.	lbs.	per acre.	lbs.	per acre	lbs.	per acre
Unmanured ..	60	1,080	908	16,344	..	..	..	..
18 lbs. of guano ..	90	1,620	1,061	19,152	30	540	156	2,808
152 " of carbonate of lime ..	99	1,782	1,237	22,266	39	702	329	5,922
10 " of saltpetre ..	110	1,980	1,318	23,724	51	918	410	7,380
37 " of bone-dust ..	108	1,944	1,328	23,904	48	864	420	7,560
112 " of sulphate of lime ..	96	1,728	1,181	21,258	36	648	173	3,114
Average per acre on the whole sowing ..	..	1,689	..	21,108	..	734	..	5,357

The following table shews the financial results per acre of each manural application :—

Rs. 18 per acre expended on—	INCREASE DUE TO MANURE.		Value of increase per acre.			Profit.		
	Grain.	Straw.						
	lbs.	lbs.	Rs.	As.	P.	Rs.	As.	P.
Guano	540	2,808	24	4	3	6	4	3
Carbonate of lime	702	5,923	36	9	10	18	9	10
Saltpetre	900	7,380	46	7	6	28	7	6
Bone-dust	864	7,560	45	8	3	27	8	3
Sulphate of lime	648	4,914	32	9	1	14	9	1

Mr. Robertson continued :—

"In the above calculations the straw was valued at Rs. 5 per ton, a low price ; and grain at the rate of thirty pounds per rupee, also a very low price. We bought the seed in Sydney last season at the rate of four pounds per rupee, the usual price in Australia for this seed ; and our sample is much superior.

"It is gratifying to find that saltpetre (nitrate of potash), an indigenous product, has given the best results ; an expenditure of Rs. 18 per acre on this manure having not only nearly doubled the crop, but, after repaying its own cost, left an additional farmer's profit of nearly Rs. 30 per acre. The value of saltpetre has long been recognised in England, but its great cost in that country has prevented its general use. Nitrogen is always more acceptable to plants in the form of nitrate than in ammonia. Nitrate of soda is very largely used in England, and so also would nitrate of potash (saltpetre) be much used if it could be obtained at the price at which most farmers in this country can procure it. This salt is best applied as a top dressing when the crop is a few inches above the ground ; 100 pounds, or at most 150 pounds per acre is enough to apply : it should always be mixed with an equal volume of sand or some similar material, in order that it may be more regularly distributed over the ground. Bone-dust stands second in my list ; probably if the continued effects of each be considered it should stand first. Next comes carbonate of lime (*chunam*). An expenditure of Rs. 18 on lime was not only repaid by the increase in the crop, but a profit of nearly Rs. 20 was added. Sulphate of lime (gypsum) comes next; this also not only repaid its original cost but left an additional profit of nearly Rs. 15 per acre. The guano repaid its cost, but only left a profit of about Rs. 6 per acre. As I have already stated, the guano was inferior ; still, I think, there are other reasons for the small return it gave. I use the word "small" return merely in connection with the foregoing results. A surplus of Rs. 6 per acre over the cost of manure is far from being an unsatisfactory profit. Until I have made further experiments I would not like to speak with any degree of certainty ; still I am much inclined to believe that the nitrogen, presented as it would be in the form of ammonia, was of very little value to the plant, and that whatever efficacy the guano possessed must be attributed to its phosphates and potash. It must not be taken for granted that because saltpetre and the salts of lime produced such good results on our soils they will necessarily produce as good results on other soils for if a soil is rich in lime or potash, it will not benefit it greatly to apply either ; though there are few soils under cultivation that will not repay the cost of either, still those results indicate the kind of food most acceptable to the cholum tribe. Each farmer should experiment, and thus ascertain for himself the wants of his soil.

"The fodder is very valuable ; all kinds of stock are extremely fond of it ; it is quite unnecessary to chaff the straw ; both the cattle and sheep eat every particle placed before them. It is rather difficult to keep it from the attacks of ants, its extreme sweetness rendering it very attractive to them.

"After removing the crop I had the stubble watered and manured, and there is now a fair second crop. But to secure the largest quantity of fodder the crop should be cut at an earlier stage than in the instances under review. We cannot hope to obtain both the maximum quantity of fodder and the maximum quantity of grain. If we obtain a large yield of the one, we must be content with a lesser yield of the other."

Mr. Robertson gave the following as the average out-turn from the different fodder crops with which he had experimented on the farm:—

CROPS.	Weight per acre of green fodder.	Average number of days required to produce a crop.
	lbs.	Days.
Yellow cholum (*sorghum vulgare*) ...	10,000	90
Yellow cholum (*sorgham vulgare*), specially irrigated	12,000	60
Chinese sugarcane (*sorgham saccharatum*) ...	20,000	8
Cumboo (*penicillaria spicata*)	15,000	75
Horse grain (*dolichos uniflorus*	7,000	70
Common paddy, specially irrigated	8,000	65

From this table it would appear that of all the crops usually cultivated for forage in the Madras Presidency, sorgho yields the greatest amount of fodder to the acre. These figures, too, shew the results of one cutting only; but sorgho is also superior to cholum, the next crop in the list, when both crops are allowed to rattoon. In an experiment made on the farm with yellow cholum (seed sown in December and the land irrigated) five cuttings were obtained, yielding 50,000lbs. of green fodder, these cutting extending over a period of eleven months. Sorgho on the other hand, will give as large a yield of fodder, and from three cuttings and the crop will not occupy the ground so long ; indeed, under high cultivation on the Government farm at Allahabad, a yield of 50,000lbs. has been obtained from one cutting, the crop remaining on the ground from three to four months only. Further, sowing of cholum, in the month of June, gave on the farm three cuttings in eight months, yielding only 17,000lbs. of green fodder while sorgho, cultivated under the same circumstances as the cholum, gave 20,000 lbs. of forage from one cutting.

In some experiments made in 1871 to test the value of sorgho as a graincrop, the average yield per acre obtained was 1,020 lbs. of grain, with 17,000lbs. of straw. The grain was valued at 25lbs. to the rupee. The average yield of yellow cholum cultivated at the same time and under the same circumstances, was 800lbs. of grain valued at 45lbs. to the rupee, and 5,000lbs. of straw. Red cholum yielded 500lbs. of grain and 4,000 lbs. of straw to the acre. Sorgho, then cultivated as a grain crop, is superior to cholum, the yield both of grain and straw being much heavier, while each product has a higher value than that of the cholum. All three crops,—sorgho, red cholum, and white cholum,—were sown in October, the sorgho being reaped in January and the cholums in February. For the sorgho 15lbs. of seed were sown to the acre, and for each of the cholums 24lbs.

In all the experiments on the Sydapet farms, the sorgho was sown at the same time as the cholum, *viz.*, in the month of October, and reaped in December or January. The soils on the farm, Mr. Robertson remarked, are of a light, sandy, inferior description, and both the sorgho and the cholum, he said do best on loamy soils. In his Annual Report for the year ending 31st March 1872, Mr. Robertson said that there had been a considerable area of land under sorgho during the season of 1871-72, the crop having established itself at Sydapet as one of the regular cold-weather crops. A large quantity of seed had been distributed over the country from the farm, and in most instances satisfactory results had been obtained. The reports of experiments in Bangalore Mr. Robertson said, were *very* encouraging, the crop seeming especially suited to the more temperate climate of Mysore. Mr. Robertson made several attempts to grow sorgho in the hot weather, but without success. The seeds would germinate well, and there would be a good quantity of plants, which, however, were invariably sickly and stunted ; and the hot weather crop never under the most favourable circumstances produced more than one-fourth of the cold-weather crop. He had, however, some hopes of establishing sorgho as a hot-weather crop, as some sorgho seed which had come into a field of cumboo as manure, from stalls in which the cattle had been fed on sorgho fodder, had sprung up and grown well with the cumboo in the hot weather. Mr. Robertson said that the sorgho could be grown as readily and with as little skill as the ordinary cholums cultivated by the ryots ; and he described the method of culture adopted on the farm as follows:—

"We usually put in our sorghum crop in a very simple way. The land is first ploughed, scarified, and weeded, and then the manure is broadcasted over its surface. This is then ploughed in, and the land is harrowed along the lines, the plough travelled (not across, as the harrow would pull up the manure.) It is then rolled, and the seed is sown with the seed drill (the country bamboo drill answers admirably), at distances varying from 12 inches to 18 inches according to the richness of the soil, at the rate of 12 to 15lbs. per acre.

"We have occasionally steeped the seed before sowing it, but I find that in dry weather the seed is more liable to suffer injury by being steeped and softened before being sown, while in damp weather there is *no necessity* for steeping it. We have also sown sorghum on ridges, and this is the best way to get a *large* crop but it is rather a tedious process in a *hasty* season, and cannot always be adopted. The land is prepared, as for sowing, on the flat up to the time it is pulverized and cleaned ; it is then ridged up by means of a plough in ridges about two feet apart. Manure is spread in the furrow between the ridges, and is covered by passing the plough along through the drills. The ridges raised over the manure are either rolled or harrowed, and the seed is sown along their tops. When the plant is grown under irrigation the practice just detailed is followed, and the water is allowed to flow between the ridges on which the crop is growing. It has been suggested that transplanting might suit the habits of the sorghum plant, but it is seldom in this country that this can be done without *great* expense and seriously delaying farm-work. Transplanting may answer well enough for planting a few square yards with sorghum in a kitchen garden, but is altogether unsuited for operations in the field, excepting perhaps under irrigation."

In other parts of India experiments seem to have been given up altogether, and sorgho was allowed to fall into neglect. The experiments that had been made, however, proved the crop to be a profitable one, and although sorgho was very generally neglected, its valuable properties recommended it to some, chiefly European planters in Upper India, who cultivated it as forage for their cattle; it appears, too, to have been under cultivation to a small extent by the natives in certain localities for the sake of its grain. It has established itself on the stud farms in the Bengal Presidency. Seed of the imphee was received at the Ghazipore farm in 1861, and the imphee has ever since that time been largely cultivated on all the stud farms, the superintendent of studs reporting in 1871 that it had been found to be a most valuable forage plant. The imphee has also established itself in the Kangra district of the Panjab, where, Mr, Baden-Powell in his *Panjab Products* says, it is used "as a valuable fodder for cattle." In the Punjab the imphee is called *Jowar Wilayiti*. Sorgho is also grown to a small extent in Burmah, and its value for providing a nutritious fodder for cattle is there fully recognised; but as fodder is plentiful, the crop is not in extensive cultivation, except in parts of Upper Burmah, where fodder is more scarce. The stalks of the sorgho are there used as forage for cattle and ponies, and the seed as a substitute for rice. The small quantity grown in British Burmah, which is chiefly in the Pegu division is put to the same use that the Chinese and the Kaffirs make of the sorgho, *viz*, the stalks are chewed for the sake of their juice. It is used thus as a cheap substitute for sugarcane, and here the advantage that it has over the ordinary sugarcane, in being more easy of cultivation and in coming to maturity much earlier, is brought into practical use in the same way as in China and Africa. The grain is used, too, as in Upper Burmah, *viz* parched, or in curries, as a variation from the ordinary rice diet, and the stalks and leaves are given to cattle. The plant cultivated by the Burmese, which is said to be the *Sorghum saccharatum*, is called by them "Pyoung-lai-gouk." and grows to the height of eight or nine feet only.

The Secretary to the Agri-Horticultural Society at Rangoon, who had imported seed of the Chinese variety from Australia for experiment, reported in July 1871 as follows:—

"*Sorghum saccharatum* has been grown in the Agri-Horticultural garden here from a packet of seed received from Melbourne, Australia where it is largely grown for the forage of cattle and horses. The experiment last year was very successful; the cattle to which the leaves and stalks were given ate it with avidity a quantity of seed was saved some of which was given to a gentlemen in the Rangoon district for trial, and some to native (Madras) cultivators about the suburbs, where *sorghum* may be seen growing in small patches in their small holdings grown, I believe, more for the sake of the grain than as forage. That it can be easily naturalized here, I gather from the fact that in the beds where it was grown last year, self-sown plants have come up this season from the droppings of the seed when the heads were cut.

"There is a difference in the colour of the seed received from Australia, the Indian varieties being either of a brownish or greenish yellow*: the former‡ are of a deep shining brownish black. The seed was sown thickly in a box in August last year, and when the seedlings were about three inches high they were pricked out and sown in beds which had been weeded and turned over once or twice (without manure) with *mamooties*. The plants grow vigorously, and when the heads began to form, in October, the stalks being between one inch and an inch and a quarter in diameter they had attained the uniform height of ten feet, although one or two that I measured were over twelve feet in height. There is no doubt that it can be converted into valuable food for cattle. Cows fed on this forage are said to yield abundance of milk."

It was not thought that the Burmese agriculturists would take to the cultivation of sorgho as they are well supplied with fodder, and as the Guinea grass, which has been lately introduced is said to be best adapted to the country; but the fact that sorgho forage can be stacked and kept dry for use in the rainy season is one which may eventually recommend the plant to the Burmese.

Sorgho, after having been neglected and uncared for, for some years was again brought prominently to notice in the year 1871. Colonel Boddam, who was specially deputed to initiate measures for the improvement of the condition of cattle in the province of Mysore, drew the attention of the Government to sorgho, which, from the accounts of its cultivation in America, and on the results of some experiments of his own, he strongly recommended as an important addition to the forage crops of that province. Colonel Boddam described sorgho as a very luxuriant kind of cholum, and he said, as an instance of its hardiness, that it had come up self-sown in the hot weather on fallow land where he had previously grown it, some of these seedlings, after the main stalk had grown up five feet and was cut down, having again thrown out six and seven large canes six feet high in full leaf, besides three or four small ones, giving, as he said, "an immense amount of fodder from a single plant."

The following is a copy of a Colonel Boddam's memorandum on the subject.

This remarkable plant is a native of the north of China. Its giant growth and its beautiful and graceful appearance and refreshing greenness in the driest season, and the expectation of finding in it a rival to sugar-beet induced the French Consul at Shanghai to send some sorghoo seed to his Government. In 1854, Mr. Browne, Agent of the United States Patent Office, took to America some French seed which was distributed by the Government. The plant was cultivated by a few farmers but it received little attention until an ex-Governor of South Carolina reported the results of his trials to a farmer's club which brought sorgho into notice. Since 1855 its cultivation has steadily increased and it is now one of the great crops of the country. It is grown in France and Algeria for alcohol chiefly and in America for seed, forage, sugar syrup, alcohol-vinegar and beer. In the ten North-Western States where it flourishes, there were, in 186[illegible], [illegible],670 acres of sorghoo, and sorgho sugar was selling at Chicago at 4½d. per lb. But for sugar, sorgho has turned out a failure. Its great merit as a forage plant is its principal recommendation, and on this point an official report of the United States Agricultural Department has declared that *the value of sorgho for feeding stock cannot be surpassed by any other crop as a greater amount of nutritious fodder can be obtained by it in a shorter time within a given space, and more cheaply.* While grass yields a ton or a ton and a half of hay, sorgho will yield from two tons to nine tons of dry fodder. Sorgho (*Lootsoh*) flourishes wherever Indian-corn flourishes.

"The seed is sown for transplanting on warm ground, finely broken in the middle of April. The young plants are watered with liquid manure as soon as they appear, and for three or four days watering is repeated night and morning if the weather is dry. They are picked out, when six inches high, in rows three feet wide and six inches from plant to plant, and are again watered with liquid manure when a foot high. Weeds are kept down by hoeing until the cane matures, about November. The crop begins to come to market however early in September or as soon as the stalks are sufficiently sweet for chewing. A Chinese labourer earning 10*d.* a day can cultivate about two acres during the six months that the crop needs his labour.

"In America it is found that sorgho can be successfully grown on all lands where a fair crop of Indian-corn can be grown. Deep, loose, warm soil, even of poor quality, produces the sweetest and most juicy stalks. Irrigation is recommended, but can seldom be attained in the United States. In deep black loam, sorgho reaches a height of 16 feet or 18 feet;—what will it not do on our future sewage farms? The juice of the giant growth is not so sweet nor is it easily crystallised. The seed should be soaked twenty-four hours in tepid water, in which one ounce of saltpetre is dissolved to every six gallons. It is then dusted with gypsum, and drilled two feet apart and twenty seeds per foot (for forage). In seven or eight days a horse subsoil plough is put between the rows, up one side, down the other. This cultivation is repeated as the crop advances, but the plants must not be earthed up. The upper roots spring from the stalk above the ground, and they must be left exposed. The first cutting may be made as soon as the crop is large enough for stock, and in ordinary seasons two others will follow. To dry the crop it should be set up in shocks, and the shock built with precautions for ventilation. One man with a sub-soil plough can cultivate ten acres."

"The Chinese and American methods of cultivating sorgho will answer in Mysore, each at its proper season. If the crop is to be sown in the early rains of April and May, the Chinese system is recommended, as there is less risk of failure from drought by sowing in a nursery bed and subsequently planting out in rows. Failure must sometimes occur when the seed is sown in drills at this season, as the rain often holds off for a fortnight or three weeks, and the sprouting seed or seedlings perish from want of moisture. Later, when the rains are regular and copious, the American system will be more suitable, with the following modifications:—

"Plough the land well and deeply, apply manure liberally, say from six to seven tons of farm-yard manure per acre, and if saltpetre is procurable and cheap, add it at the rate of 100lbs. per acre. Plough this manure crosswise to the first ploughing, harrow and level, then sow the seed in drills twenty-six inches apart, and twenty seeds per foot. In seven or eight days put a bullock hoe or cultivator between the rows, up one side, down the other, or hoe the rows by hand. Continue the cultivation as the crop advances, but in no case earth up the plant stems, as they send out roots above ground which must be left exposed. The first cutting should be made just before the canes show signs of flowering; the plants will send out side shoots two or three at a time for successive cuttings, affording a supply of excellent green fodder extending over a period of six or eight weeks. If the crop is to be used for dry fodder, the canes, when cut, should set in shocks, and the shocks built with precautions for ventilation. If the crop is required for seed only, the leader of the canes should be left to flower and mature its seed, while all the side shoots may be cut for fodder.

"Under this system of dry cultivation and high farming at Hunsur near Mysore, a plot of 1,296 square yards of very rich land, which had long been under cultivation, and was heavily manured before hand produced 12 657¼ lbs. of fodder and 1,498¼ lbs. of seed equivalent to 21 tons, 1 cwt., 1 quarter, and 10 lbs. of fodder per acre, and 2 tons, 9 cwts., [illegible] quarters and 5 lbs. of seed: this very large out-turn is attributed to the extreme richness of the land, a favourable season and high farming. Again, in the Túmkúr district, in the rich black soil of Gubbi, where sorgho was tried, the canes attained the height of 18 feet, and a very heavy crop of fodder was cut. Unfortunately the weight per acre was not recorded. On the average light soil of Bangalore, with a moderate supply of manure, upwards of 10 tons of fodder were cut per acre. Even this last-mentioned crop far surpasses the out-turn of any grass grown in the province, and is superior to the average out-turn of an acre of the country jowar or cholum.

"So much for the results of high farming; no doubt in favourable seasons a fairly remunerative crop might be raised even under the native system of light ploughing, scanty manuring, and careless weeding.

"The seed could be sown with the Sudiki*—(see *Buchanan's Mysore*, page 261, plate XI)—or country pulse drill; three of these pulse drills tied to the native harrow and served by three men would do for the sowing process, followed in due course after a fortnight by the country bullock hoe.

"There are a great many kinds of so-called sorgho (the two real sorts are the imphee, or red seed† already known in parts of India, and the black seed of North China), the last-mentioned containing most saccharine matter. As the several kinds hybridise freely they should be grown separately, never near each other: when the seed is formed the crop must be watched and birds scared; parrots are particularly fond of the seed and destroy immense quantities if left undisturbed.

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*It is *imphee*, evidently, that is referred to here.

‡ The Chinese sorgho,

* Also styled Sadde or Kal Kurige.

† The *Otaheitan* variety of imphee is red seeded. This is the variety most naturally cultivated of all the imphees in the United States of America and probably too, in India:—*F. G. W.*

"To sum up; the superior merits of the *sorghum saccharatum* over grasses consist in (1) its heavy crop; (2) the rapidity of its growth; (3) its abounding in saccharine matter; (4) its power of standing heat and drought, and of being grown nearly all the year round, especially in the dry and hot months, when every kind of grass is burnt up; and lastly, that with high farming it is a most remunerative crop."

Colonel Boddam obtained the seed with which he experimented from England. His attention was first drawn to sorgho by seeing an extracts from papers which had been read to the Asiatic Society in 1870, stating that sorgho was extensively cultivated for forage in America. Writing of sorgho in April 1872 from Bangalore, Colonel Boddam said :—

"In my paper on its cultivation I pointed out that sorgho is grown in North China in the summer, which is there exceedingly hot, and here I find it does best as a dry crop, when sown in the earliest rains that precede the monsoon. Here we get showers in May and I found the sorgho came up then self-sown on the plot I had cultivated the previous cold season, and that the self-sown plants did well without any care whatever; they were in fact superior to the crop sown and carefully cultivated at the end of June. This year again I grew some sorgho at the beginning of the year, and am cutting it daily now for my cattle, the crop standing the heat and drought of our Bangalore summer very well, and being most acceptable to the cows and calves when it is impossible to get any other green food.

"The sorgho sown in the beginning of the year has only been occasionally watered, say once a week or once in eight days, and this has been a most unusually dry and hot season. Another point worthy of notice is that the crop is not cut all at once, but as the plant sends out successively a series of six to eight canes, these should be cut successively when the flower expands, so that you can obtain a quantity of green food spread over several weeks; and it is when cut in this manner that the enormous weight of fodder is realised; whereas with jowaree, the stalk is cut down once and there is an end of it. * * * *.

"The seed, besides being utilised as seed-corn at the rate of 1¼lbs. for an acre, can be made very useful for feeding poultry; they are very fond of it when once accustomed to it. Pigeons and parrots I had to scare away from the field."

Colonel Boddam thought that there was no doubt as to the success of sorgho as a first-rate forage crop of Mysore, and he remarked that the cows at Bangalore which had been fed on sorgho immediately improved in condition, and that the butter made from their milk greatly increased in quantity. This was certified in the local newspaper, and without reference to Colonel Boddam in any way; indeed, it is well known that the saccharine richness of the sorgho makes it especially valuable as fodder for milch cows.

Colonel Boddam's memorandum was forwarded to the several local Governments and Administrations under the Government of India, with instructions for extensive circulation to all who would be likely to take an interest in sorgho. Experiments with sorgho as a forage crop were then systematically undertaken, and with the following results :

The Chief Commissioner of Mysore, reporting on sorgho in July 1871, said that in 1859 seed of the Chinese sorgho, which had been obtained from America, was, at the request of the Madras Board of Revenue, distributed throughout the province for trial. The results of these experiments were not on record, but the Chief Commissioner had been informed "that although the soil and climate were not found to be at all inimical to the plant, no desire was evinced by the people to extend its cultivation; and as in other cases, the prejudices of the people, whether well founded or otherwise, proved fatal to any expectation of the plant being introduced generally for cattle forage, in which its chief utility consists."

In 1870 sorgho was tried again, at the instigation of Colonel Boddam, but only on a very limited scale. In 1871 all the experiments carried out in various parts of Mysore (seed having been sown in June) turned out badly owing to the continued want of rain. Colonel Boddam, however, managed to raise a crop in the same season, and the Superintendent of the Cattle Farm at Hunsur, who planted as a cold-weather crop, obtained very satisfactory results. On the 24th June Colonel Boddam sowed 2,364 square yards of land with seed, according to his own method, *viz*, at the rate of 20 seeds per foot in drills 26 inches apart. The land was deep-ploughed with English ploughs, and the subsequent cultivation was with bullock hoes of improved English pattern. The crop, being grown for seed, was not cut till the 3rd November, when the yield per acre was at the rate of 470lbs. of seed and 13,144lbs. of green fodder.

The Superintendent of the Cattle Farm at Hunsur sowed 1,296 square yards with sorgho seed in October. The land was dressed with lime manure, and the experiment was carried out on the dry cultivation system. The yield of green forage, cut in January, was at the rate of 47,190lbs. or over 21 tons, and of seed at the rate of 1,498lbs. per acre. This large yield is one of those referred to by Colonel Boddam in his memorandum.

In forwarding the reports on the above experiments the Chief Commissioner observed as follows :—

"With respect to the value of sorgho as an article of fodder, there appears to be no doubt that it will grow fairly in this province as a dry crop, *i. e.*, or on land not irrigated during the rainy season, and that if cut for fodder before seeding, it is well suited for cattle, especially milch cows, their milk being enriched to an extraordinary degree by its use in small quantities. The natives, however, do not appear to care for or value it, and probably think more of the ordinary *cholum charra* (or jowar fodder stalk), which grows to a height of 10 or 12 feet in many fields near Bangalore."

The Chief Commissioner was anxious to have induced some of the large cattle owners of Bangalore to arrange for the cultivation of sorgho for the use of their cattle, in sufficient quantities to give the value of the plant as fodder a fair trial; but he was not able to succeed in interesting them in the plant.

Colonel Boddam continued his experiments with sorgho in the years 1872 and 1873. In 1872 he grew the crop again for seed. Eighteen pounds of seed were sown on the 1st July on an area of 1 acre and 2,087 square yards. The only manure used was indifferent farm-yard manure, and the crop was cultivated in the ordinary native way. The total outlay incurred, including Rs. 6 for threshing and cleaning the seed, Rs. 8 for watching the crop as a protection against birds, and Rs. 4-6 for land assessment, was Rs. 38.14, the produce being 17 tons of green fodder valued at Rs. 19, and 860lbs. of seed valued at Rs. 43* or a total value of Rs. 62, giving a profit on the crop of Rs. 23-2. The results per acre would have been, approximately—

Cost of cultivation		Rs. 27 2 0
Yield of green forage, 12 tons valued at ...	Rs. 13 0 0	
,, seed, 601lbs. ,, .. ,,	30 0 0	
Value of yield		,, 43 0 0
Profit		,, 15 14 0

Colonel Boddam compared this result with raggy and jowar, which are largely cultivated as dry crops for fodder in Mysore. The cost of culture of the same area, *viz.*, 1 acre and 2,087 square yards, of either of these crops would have been Rs. 10-7-9; the value of the produce Rs. 16-4-2 (seed and fodder); and the profit on either crop Rs. 5-12-5, which is much less than the profit yielded by the cultivation of sorgho, which was Rs. 23-2. The greater value of the seed of the sorgho, in comparison with that of the raggy and jowar, is the chief cause of this result.

(*To be continued.*)

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* The seed is here valued at 20lbs per rupee, which is the price at which it was selling at Bangalore.

AGRICULTURAL STOCK.

MR. W. H. OAKES, of Madras, has been importing some first rate cattle into the Madras Presidency, with a view of improving the native breed. Dr. Shortt has pronounced them to be finer than any thing that has ever been imported. The object is, we are given to understand, to improve the cattle in the Wynaad, and the animals have been obtained from North Devon, England. We trust Mr. Oakes's venture will prove successful, that the Wynaad cattle will be improved, and that he may meet with more material reward than pioneers in most enterprises are wont to do.

THE subject of breeding mules in places like the Remount depôt at Oosoor, was lately considered by the Madras Government, in communication with the Remount Agent, Colonel Arthur Drury. Mr. Robertson, of the Sydapet farm, suggested that it would be profitable for Government to breed its own mules. Colonel Drury is, however, of opinion that it would be a simple waste of money to attempt the experiment, and that to send mules to the hills during the dry season will not suit, as there is little or no water to be had there during the dry season. In 1874 the Government obtained twenty mules from the Punjab at a cost of Rs. 165-10. These turned out well. But to attempt to breed cattle at Oosoor, Hoonsoor, or Kongiem it is thought would be useless. The Commissariat officer is not always at Hoonsoor and his absence will interfere with the satisfactory working of the experiment. As both the Remount Agent and the Commissary General are opposed to the proposal made, it has been considered advisable to abandon all idea of any proposal for breeding mules.

THAT preparations from cotton seed, make excellent feed for cattle sheep, and pigs, is well known. The article, in one form or other, is used by hundreds of tons yearly in England. The kernels only of the seed are used for the purpose stated, and they are either first crushed for the oil they yield, or the entire kernel is used, being mixed with very finely cut hay, or with bran. The latter is particularly rich, and is only given to animals used to compressed feed, and that are being fattened off rapidly. The residuum from the oil presses, is the article more commonly in use. From it is made cotton seed cake, a feeding substance of high repute. But the cotton seed in its raw state, with its hard woody shell and woolly fragments adhering to it, is not a wholesome feed. Pigs are very fond of cotton seed in the raw state, and experiments have been tried with them, in Australia, to see how long they could eat of it, before being injured. Fattening pigs grew rapidly for two or three months, and then commenced to suffer. When the seed was allowed to heat or ferment before they had access to it, the mass proved to be more digestible, and the practice was a common one for some years, to give small portions of fermented seed to pigs that were being fattened, for a month or two before they were killed. But the better way to use the article is to have it crushed or hulled, and then to feed it with cut hay, corn stalks, sugarcane, or other bulky material. It is then a desirable feed stuff, and one that would be very valuable during the present season of scarcity. In the best of seasons it would be valuable as giving an ingredient, and oily matter, of which even the best of the native grasses are deficient, and in which they become more and more deficient as their seed heads become scarcer.

WE are sorry to hear, that cattle disease is still very prevalent in the North of Wynaad, and is reported to be on the increase. We have not yet heard of any cases in the South, and hope that southern planters may yet escape the terrible scourge.

We hear that the sheep farm at Prome is offered for sale to the public on the understanding, that the purchaser maintains it as a sheep-breeding speculation. We doubt, says the *Rangoon Gazette*, whether any private individual could be found who will embark in this enterprise unless the Government offer some liberal support.

Ponies appear to be plentiful and therefore cheap this year in Moulmain. Almost all the Moulmain hack gharries compare favorably with those of Rangoon in the matter of horse flesh. There were several fine well matched pairs purchased for Rs. 200 to Rs. 300 per pair, any of which in Rangoon would fetch Rs. 500.

We hear that the breeding farm at Kokine is to be shortly opened, under the auspicies of Dr. Frost. The preliminary expenses we believe will not exceed seven hundred rupees at the outside.

FORESTRY.

Mr. Ribbentrop, after inspection on different occasions of the forests on the Irrawaddy, has submitted an elaborate report of the reproduction of teak and its conservancy in the newly formed district of Tharrawaddy, on the eastern banks of the Irrawaddy.

A tree felling Machine, patented by Messrs. A. Ransome & Co., of Chelsea, was tried lately on the Roupell Park Estate, Tulse Hill, when several trees were successfully felled. The machine is a saw driven by steam power, and it cuts the timber close to the ground. An elm, 2 feet 9 inches across the cut, was felled in less than four minutes, and another 22½ inches in diameter, in a minute and a half.

The walnut tree, we hear, flourishes in the Neilgherries. Several may be seen at Slangollen, Mr. Frend's farm, where they were introduced about 20 years ago. The trunks of them are about a foot in diameter, and the trees have attained a height exceeding 20 feet, within the last three or four years. The oldest of these trees commenced to yield a crop of nuts last year. As many as 2,000 nuts were gathered off a single tree. Eaten fresh the nuts are delicious, though some think them harsh until they have been kept for a while. The tree winters during the cold weather, and in the early spring exhibits an umbrageous head, thoroughly healthy, and looking as if the tree was in its natural habitat.

We note that the Pongay tree, which is to be found plentifully scattered along the avenues of public roads of Bangalore, is this year yielding a very heavy crop of nuts. The nut of this tree yields an excellent oil, which is largely made use of, the refuse after extracting oil being valuable as a manure.

The Carob plant cultivation, undertaken by the Forest department at Prome, British Burmah, has, we hear, turned out a failure. Experiments are, we believe, to be continued.

In Austria, there are 500,000 cwts. of gallnuts gathered annually and the forests yield to commerce 100,000 cwts. of potash, 250,000 cwts. of turpentine and resin. and 4,000,000 cwts. of tanning bark.

We learn that the Forest Department will turn their attention to the working of the new forest circle of Pegu, in the division of Rangoon, this season.

The cultivation of the Carob in the Toungoo hills has also proved a failure. The climate is not dry enough for these tender plants. The experiment may possibly succeed if tried at the foot of the hills or in the plains.

THE CULTIVATION OF THE "EUCALYPTUS GLOBULUS" AND OTHER AUSTRALIAN GUMS IN INDIA.

(*By J. E. O'Connor.*)

For many years past the Government of India has been importing large supplies of seeds of the trees of this family, and chiefly of the *Eucalyptus globulus* (blue gum). These seeds have been widely distributed with the object of acclimatising such useful trees in the parts of India best suited to their growth. The experiment has not been particularly successful, and in fact it may be said that the trees have lived only in two places—the Nilgiris and Ranikhet. In the Nilgiris their cultivation has long passed beyond the experimental stage. I have seen it stated somewhere, that in places the growth of these trees has quite changed the aspect of the country. Official reports all testify to the rapid growth of the Australian gums. In the Madras Forest Report for 1868-69 it is stated of the blue gum that "its rapidity of growth on these hills exceeds that of any tree indigenous or introduced, and has been the admiration of all forest officers who have visited our plantation." This rapidity of growth was particularly noticed in the *sholas*, and it was recommended that as these were thinned out for firewood, they should be renewed with this tree. "It exhibits the most favourable growth when planted inside *sholas* of the indigenous trees (particularly in the ravines,) as it soon overtops all the native trees, and it has complete shelter from the wind when young. One tree in such a locality in the grounds of Gayton Park at Ootacamund is quite a sight: it is upwards of 12 feet in girth and of enormous stature." The Commissioner of the Nilgiris wrote in December 1860: "It may be said to be established that certain species of the *Eucalypti* grow splendidly on the Nilgiris and four times as fast as the teak tree grows anywhere, and that the timber of the *Eucalyptus* is at least equal to teak for the various purposes for which teak-wood is wanted. The following is an account given in August 1868 by the Conservator of Forests in Mysore of the Nilgiri plantations of *Eucalypti* visited by him in company with the Madras Conservator:—

1. I have the honor to report, for the information of the Commissioner, that I lately visited the Government plantations (at Ootacamund) of *Eucalyptus* and other useful timber trees, chiefly exotics.

2. Major Beddome, the Conservator of Madras, at my request kindly took me over them, and gave me much valuable information. I would respectfully suggest that, if the Commissioner should consider the experiment worth trying, seeds of the various kinds of *Eucalypti* might be obtained from the Australian Government, and these valuable timber trees be introduced into Mysore.

3. In the plantation we first visited about forty acres had been planted out with the *Eucalyptus globulus* (blue gum). The planting was commenced in August 1865, and the trees had grown capitally. I measured two trees planted out (seedlings) in 1865. One measured twenty-four feet, the other thirty feet, to the top of the terminal shoot, and in girth respectively thirteen and eighteen inches. Major Beddome tells me the timber is equal to teak, and, in spite of its rapid growth, is good close-grained wood. The growth, in the Ootacamund climate of this tree is almost incredible. In the public gardens is a specimen of *Eucalyptus globulus* now twelve years old. It is about 100 feet in height and measures six feet in girth, nearly, at three feet from the ground. This specimen branches low; but it was grown as an ornamental tree, not for timber. To thrive well, the *Eucalyptus* requires an elevation of 4,000 feet; several sites could be found in Coorg, Munjerabad and Nagar for its propagation. It is very hardy. In the plantations I visited there had been scarcely one casualty in the first year; last year some young trees had been killed by frost, especially those in low and marshy ground. But apart from the frost, the tree flourishes best in damp ground; the largest tree in the plantation grew close by the side of a stream, and its roots were entirely surrounded by water.

4. The manner of propagation is as follows: Nursery beds having been prepared, the seeds are sown broadcast (generally in December or January in Ooty), and covered lightly with earth to the depth of quarter of an inch. They are watered copiously. When about three months old, they are taken up, the roots covered up with earth, and then with moss, and the plants are in that state placed in fresh beds, or even (in this climate) simply under *pandals*, without being put into the earth. Here they remain for about a month to recover themselves, and they are then planted out in pits or trenches, each plant being six feet distant from the next. The dimensions of the pits and depth of the trenches varied considerably. Some of the pits were three feet cube, others only eighteen inches cube. The depth of the trenches too varied from eighteen inches to thirty-six inches. A uniform depth of two feet and breadth of two feet for the trenches, or pits two feet cube, would perhaps be the best. If the spot where the seedlings have been planted out is well protected from the wind, they require no further looking after. Should, however, the wind get at them, it is found necessary to remove almost all the leaves, as the plant is apt to get top-heavy, is blown over and injured. Being planted out at only six feet apart, they draw each other up, and require no pruning, the lower branches dying off naturally.

5. If introduced into Mysore, we could not moss the plants. Major Beddome advised my using bamboo pots, which have answered well up here. The young seedling, on being first moved, is put into the bamboo, which is then placed on the ground under the shade of *pandals*; when the time for planting has arrived, the young plant is pushed out with a stick.

6. We then went on to Major Morgan's plantations. Here I saw a thriving plantation of *Eucalyptus globulus* aged seven years, I measured one specimen. It was four feet in girth at six feet from the ground and seventy feet high, measuring about twenty-five feet to the first bough. The girth of this specimen was exceptional, but there were several hundreds of trees which would have measured about three feet or three and a quarter feet in girth. They were all well grown, with clean stems, and had never been pruned. They stood at six feet apart, and Major Morgan has this year commenced thinning them out. Grass grows well under the shade of these trees.

7. At Major Morgan's plantations I saw specimens of the *Eucalyptus globosa, E. pederetta, E. citriodora,* several kinds of stringly barks—all *Eucalypti* from Australia. They were growing well. Major Beddome advises the introduction of the following trees as the best known timbers: *Eucalyptus globulus, Eucalyptus sideroxylon,* and *Eucalyptus marginata*—a valuable timber and said to be obnoxious to white-ants.

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The leaves of all the *Eucalypti,* especially when the plants are young, are full of oil glands. The *Eucalyptus globulus* leaf has a strong taste of camphor, and goats even will not touch it.

Large plantations have since been formed by the Forest Department on these hills, and have succeeded admirably. In the plain districts of Madras, however the attempt to grow the Australian gums has been a complete failure. Repeated notices have from time to time appeared in the public journals on this subject, but the last notice I find is the following quotation from a recent report by the Sanitary Commissioner for Madras:—

I observe in the newspapers that the subject of the cultivation of the *Eucalyptus globulus* in marshy places has been under consideration with reference to the drainage of village sites and protection of the health of the people in the Godavery district. As the order of Government on this subject has not been communicated to me, I am not able to submit any remarks on it; but in regard to the general question of the cultivation of the *Eucalypti* in the plains of India, I have the honor to state that the experiment is almost certain to fail. Looking to the importance of introducing malaria destroying trees, I have personally been endeavouring to grow the *Eucalypti* in Madras, but, so far, without any hope of success. The seeds germinate, and the plants grow rapidly under shelter, but they seem unable to bear the great solar heat and die off when planted out. They thrive but indifferently in the elevated plateau of Mysore, and it is only in our hilly ranges, with elevations of 4,000 feet and upwards, that they appear to grow vigorously. Judging from the results of experimental trial of these trees in Madras, I do not think there is any chance of their flourishing in the delta of the Godavery river.' But while the cultivation of the *Eucalyptus* in the Godavery district may be impossible, there are plenty of trees which may be substituted for it. The supposed virtues of the *Eucalypti* in neutralising miasmata are probably exaggerated, and whatever power they have in this way is possessed in common with many other resinous-odoured plants, like casuarina, mango, jack, &c., which grow freely in the plains, wherever they are planted and taken care of. I would submit therefore that the spending of money on an exceedingly doubtful experiment is unadvisable, when experience has shown us that trees of similar properties with the *Eucalypti* may be raised with every prospect of success in the eastern coast deltas.

Major Beddome, the Conservator of Forests, is of opinion that the *E. globulus* cannot be grown in the latitude of the Madras Presidency lower than 4,500 feet. Colonel Morgan, Deputy Conservator in the same Presidency, says, that *E. globulus* is best grown at an elevation of 6,000 to 7,000 feet; the red gum (*E. rostrata*) at 5,000 to 6,000 feet; the jarrah (*E. robusta*) at 4,500 to 6,000 feet.

The experiments made by the Conservator of Forests in Mysore have not been successful. The first sowings in 1870-71 failed, owing, it was said to a large proportion of the seed having lost its vitality before receipt in India. In 1871-72 plantations of blue gum were commenced in Nagar "with poor success, as out of 6,490 seedlings transplanted, 5,816 died." In 1872-73 the annual report informs us: "The exotics, chiefly Australian, introduced into the plantations have failed in large numbers, and those which have so far succeeded require special care. The attempts to grow the jarrah (*E. rostrata*) in Nandidrug have been successful so far, and the young trees look very healthy."

In Bombay, as far as we know officially, no attempts have as yet been made to introduce these trees; but I see it stated in a newspaper that the *Eucalyptus globulus* is thriving in the Victoria Gardens in the town of Bombay. The Commissioner in Sindh has circulated a paper recently written by Dr. Morton recommending the cultivation of the *Eucalypti* in that province, and he has sent for a large quantity of seed with which to commence experiments wherever possible.

In Bengal all the attempts made to grow the *E. globulus* in the Botanic Gardens have failed. The seed sown has often germinated without difficulty and in quantity. Plants have also attained the height of eight or ten feet, but then they die out. Dr. King says that the chief difficulties of cultivation begin when the roots have become sufficiently long to reach the water-level. He attributes the failure of the tree to the high water level in the subsoil, the high temperature, and the alluvial nature of the soil of the province. Recently on a suggestion made by a native newspaper for the cultivation of the *Eucalyptus globulus* in the fever-stricken tracts of Burdwan and Hooghly, a letter was written from this Department to the Government of Bengal No. 489, dated the 7th May 1874, an extract from which is appended:—

Although the alleged anti-miasmatic properties of this tree are problematic, there is no doubt that the introduction of fast-growing aromatic trees, like the gum trees, which moreover produce serviceable timber, can only be advantageous. The species of *Eucalyptus* which grow luxuriantly on the Nilgiris, and which are cultivated in Provence and Algeria (*E. globulus, obliqua,* and other species), are from the temperate climate of Tasmania and the southern parts of Australia. These do not thrive at Calcutta, and would not thrive in the Burdwan district. But there are numerous species of this genus which inhabit North Australia Queensland, and other parts of tropical Australia, which, the Government of India is informed have been cultivated in the Calcutta Botanical Gardens, but hitherto without success; and I am to suggest for His Honor the Lieutenant-Governor's consideration that Dr. King might be encouraged to persevere in his attempts to introduce the gum trees of tropical Australia.

Dr. King says that even these species have never succeeded in Calcutta, but he has sent for seed in order to carry out the experiments suggested, and promises to report the result. There are now, Dr. King reports, about sixty or eighty gum trees in the garden, many of them being from fifteen to twenty feet high.

It is understood that the experience of the Calcutta Agricultural and Horticultural Society is much to the same effect as Dr. King's.

In Assam the only record of an attempt at the cultivation of these trees that I can find is recorded in a recent report of the Agricultural and Horticultural Society. Dr. Imthurn, stating the result of an attempt to grow the *Eucalyptus globulus* at Tezpur, Upper Assam, writes as follows:—

I found it impossible to get the seeds to germinate in the open, apparently owing to the soil being too moist.

Sown in pots, the seeds germinated pretty freely (from one-third to one-half of the number sown). The time required for the germs to appear above ground was from five to twelve days, generally nearer the former term. The young plants unfortunately look weak and premature, and are very slow in making leaves.

The stalk bearing the cotyledons seems to have grown too fast, and proves too tender. Heaping up fine earth round the stalk does very little good beyond preventing the stalks from bending under the weight of the cotyledons.

I have often noticed the same premature state with cold weather plants, which I wanted to raise during the rains so as to have early seedlings. *Its* causes are, as far as my experience goes, either—

too rich soil, or
too much humidity, or
too little light (reflected or directed), or
too high temperature.

I have varied my experiments so as to satisfy myself that the premature state of the young *Eucalyptus* plants is not due to any of the first three causes just mentioned, and it seems therefore that high temperature was the cause of the weakly state of the young plants.

These remarks having been referred to Mr. Kurz, of the Royal Botanic Gardens, he said that in his opinion the failure of *Eucalyptus globulus* in Assam was ascribable both to too great moisture and heat.

It is true that the tree grows best in moist valleys of Victoria and Tasmania, and must there be subjected to a good deal of dry heat during the hot season; but still the distribution, which ranges from 37 degrees to 44 degrees south latitude, indicates its unfitness for the Assam climate, while it will no doubt prosper in the North-Western Provinces, &c., and still better in the Mediterranean countries.

Dr. F. V. Mueller has sent us another species less temperate than the above, *viz., E. rostrata,* and I enclose a few seeds for Dr. Imthurn for an experiment in Tezpur. Dr. F. V. Mueller thinks that this is the best kind for tropical regions in India, and possibly Dr. Imthurn may be inclined to try it and let us know by and bye with what results.

These seeds were sent with Mr. Kurz's remarks to Dr. Imthurn.

In the North-Western Provinces, Kumaon is the only locality where experiments have been officially tried. In his report for 1870-71 the Conservator wrote: "The climate and soil of Ranikhet are evidently well suited to the Australian gum trees. We have now gained considerable experience in the cultivation of these very valuable trees, and I am convinced that the best mode is to break up patches of ground and sow the seed broadcast on the spots the trees are to remain on; for although the young saplings are not killed by transplanting, their growth is very considerably delayed. The seed should be sown in the rainy season, and it will then germinate in about eight or ten days. The blue gum is doubtless the quickest grower, and will do well enough for fuel; but I doubt its being of much use for timber, and I am rather afraid that it will be liable to get broken by the severe gales of wind peculiar to the Himalayas. . . . I have directed Mr. Craw to break up open patches of ground in the forest and sow all the gum seed he has, and next year I mean to go on with this work on an extensive scale, and there are many acres of small open spaces on the Ranikhet hill which I hope to get covered with gum trees in this way."

He was also going to try further experiments at Chakrata.

In 1871-72 Mr. Craw reported from Ranikhet: "7,600 gum trees have been planted in cantonments, and with few exceptions are doing well. * * * In February last about 300 gum seedlings were taken from the Ranikhet nursery and planted at Mohanu (Kumaon). By the end of June these little trees had grown from four inches to six feet in height, but I have since heard that many of them died soon after the heavy rains set in. If this is the case, the gum tree will not do in such a damp climate as the Bhabur. A small quantity of gum seed was sown near Chakrata, but the heavy snow of last winter rotted it, and not one single seedling appeared. However, I fear the gum tree is not suited to that cold and bleak climate."

Mr. Craw's last available report, dated 26th March 1873, shows that he had then between 15,000 and 16,000 gum trees, and was expecting a large increase to his stock from fresh sowings. He considers that they have become acclimatised at Ranikhet, and gives some measurements in support of his opinion. The oldest of the gums planted in August 1869 was 30 feet high when he wrote, and a number of others planted in August 1870 ranged from 15 to 20 feet, the average being nearly 18 feet. He finds the seeds succeed best when sown in early spring. The young plants thus attain a few inches in height before the rains set in and are not liable to rot off in the seed beds or in transplanting, which they do when from any cause the sowing has been unseasonably deferred.

Colonel Ramsay says that the *Eucalyptus* grows admirably at Naini Tal at an elevation of 6,700 feet and at Doonagiree at an elevation of 6,500 feet; "therefore," he says, "it may be fully admitted that it does not suffer from the frosts to which hills to a height of 7 000 feet are liable." Captain Birney in a small experiment found the *E. globulus* the quickest grower of the seven gums he tried; it attained a height of six feet in one year.

In the Punjab repeated attempts have been made by the Forest Department to raise the various species of this genus. In his *Punjab Plants* (page 93) Dr. Stewart says: "These Australian trees have as yet not been found easy to raise in the Punjab, although improvement is taking place in that respect. But several of the trees, which have succeeded at Lahore and Madhopur, where they were first introduced in 1860 by seed obtained from Dr. Chalmers, have grown at least twice as rapidly as the ordinary Punjab trees." Dr. Stewart does not specifically mention the blue gum, and it is not probable that this was one of the kinds which he mentions as having succeeded. Seeds of E. *gigantea* (from Adelaide), *E. sideroxylon* (iron-bark from Victoria), and other species have been obtained from time to time and tried in the Changa Manga plantation without success. The blue gum always failed. Writing in April 1870, Mr. Baden-Powell reported that the experiments had been "so very satisfactory, that a more systematic effort to grow the tree on a large scale is desirable." He said that *E. sideroxylon* had been very successful. Further experience, however, caused Mr. Powell to change his opinion. In February of the present year he wrote: "The only place we grew gums was at Changa Manga, and the plantation officers there have tried all sorts of species. We obtained a large amount of seed, gave it a fair trial, and concluded that our plains do not suit the *Eucalyptus* species, but that the lower hills would be their proper place." Of the *Eucalytus globulus* he said. "It is *the* most difficult of all the gums to rear in the plains. They have been tried and always failed at Lahore. I had one, I think about the third or fourth in all Lahore, that survived and grew, just as Mr. Hume describes, in a hectic, unhealthy sort of way." These remarks were made on a request from the Government of the Punjab for seeds of the blue gum, which Dr. Scriven, attracted by the newspaper reports of the properties of the tree, wished to try in the central jail. He also recommended its being planted along the banks of canals in those districts where the canals had increased fevers. This Department asked the Government of the Punjab to enquire into the results of the trials made at the Changa Manga plantations, saying that if after considering them it was of opinion that further trials would be useful, the application for seed might be renewed. This was last February, but no further communication on the subject has been received from the Punjab. There is a blue gum at Simla in the grounds of the Simla Bank. It is *not* a particularly good specimen, but its existence shows that when once established the tree can stand frost fairly well. This tree is some years old. I sowed a quantity of blue gum seed at Simla in the spring of last year. The plants grew rapidly, and I gave away a number of them when they were about a foot high. Those that I kept stood the winter fairly, though it was very severe, and were in good condition when I left at the end of January. But it was evident that if they had not been sheltered, the seedlings would have perished, and it seems certain that the frosts of Simla are too severe for the tree in the early stages of its growth to admit of its satisfactory cultivation on a large scale at that altitude.

In Oudh the *Eucalyptus globulus* has been tried without success by Dr. Bonavia. In his report for 1873-74 on the Lucknow gardens he writes:

So much has been written lately about the *Eucalyptus* that a few words upon it may not be uninteresting. Several years ago some seed which was ticketed *E. globulus* germinated well, and several of the plants throve and were planted out. Most of them died one rainy season; two escaped and grew to about 30 feet high. The leaves had a bluish bloom on them and were very fragrant. The leaves of the lower part of the tree were totally different in shape from the upper ones. Both these trees died during a subsequent rainy season. I have now in the Horticultural Garden 22 trees of another kind of *Eucalyptus* which Dr. King, the Superintendent of the Royal Botanic Gardens, thinks is the *marginata*. If so, he states it is a very valuable timber tree and equal to the mahogany. This kind thrives very well. Some specimens, I should say, are about forty feet high. They don't mind the hot winds, the rains, or the frost. Some have flowered but not seeded yet. This may be a good kind to introduce into the Oudh forests.

We have no record of any other attempts to introduce the blue gum into Oudh.

In the Central Provinces the only attempt made, as far as we know, is a recent experiment by Colonel Wood, Deputy Commissioner of Sironcha, who brought out a large quantity of seed with him after his return from furlough, meaning to introduce the tree in the Central Provinces. I can find nothing as to the result of this experiment.

The only other place where, so far as our knowledge goes, the *E. globulus* has been tried is in the Nicobars. The seedlings appear to have done fairly there yet, but the success of the experiment is problematic. A report has been called for after a year's experience.

Thus it appears that after repeated experiments the *Eucalyptus globulus* has succeeded only at Ranikhet in the North Western Provinces and on the Nilgiris in the Madras Presidency. Even in Mysore and Coorg, at an elevation which might have been supposed not unfavourable to the tree, it has failed. Heavy charges have been incurred from time to time on account of the importation of seeds from Australia, and it seems questionable whether it is worth while going to much further expense in the attempt to introduce the tree on the plains of India. It is a native of the cool, temperate zone of the Australian Continent and Tasmania, and its unsuitablity to the tropical plains of this country seems now manifest. It might probably succeed well on the lower ranges of the Himalayas. In these localities it is hardly wanted as a malaria-destroying agent, but it might be useful in the reboisement of such bare places as the chain between Kussowlie and Simla. The aromatic emanations from the tree are so strong, that it is said cattle will not touch it. In this respect and in its extremely rapid growth at (Ranikhet the growth of a particular tree during the course of a year measured no less than 18 feet) it possesses great advantages.

Certainly, if the tree possessed all or even half the virtues currently attributed to it, Government would be bound to make the most strenuous efforts without reference to cost for its universal establishment in India. Here is a list of some of the virtues ascribed to it: when thickly planted in marshy districts the subsoil is speedily relieved of its superabundant moisture as if by pipe drainage, the tree absorbing daily ten times its own weight of water from the soil. Miasma ceases wherever it flourishes, and fever flies before its face. The healthiness of the Australian climate is caused by the emanations from the tree. The bark and leaves possess febrifugal and antiseptic properties. It is valuable as a disinfectant and as an active agent in the treatment of diseases of the larynx and of the mucous membrane generally; its leaves make a good lozenge for the throat, and baths in hot water in which the branches and leaves have been infused remove rheumatic pains, neuralgia, and the debility left by malaria. It is praised as a perfume (to which the name *Eucalyptol* has been given) and as a cigar to promote digestion and for bronchial and asthmatic affections. And last, but not least, it has been discovered to be an infallible remedy against the *phylloxera vastatrix* thus, inoculate the vine attacked with the pure essence of *E. globulus*, and in three days the *phylloxera* entirely disappears, while the vine is uninjured. It is not stated that the Abbé who made this great discovery has claimed or received the reward of three hundred thousand *francs* offered by the French Government.

This catalogue of the virtues of the gum makes one think of the wonderful powers supposed three hundred years ago to be possessed by that "most holy herb," tobacco. Clearly such statements want confirmation before they can be accepted. They bear indeed on their face the mark of exaggeration. In one of the papers in which an account of the properties of the tree is given it is stated that the British Government has largely grown it in India and on the west coast of Africa with astonishing results in the diminution of fever. Now we know that in India no such results have been obtained, and on the west coast of Africa attempts are only now being made to introduce the tree, and Dr. Hooker is very doubtful of its succeeding there. Mr. Broughton, Government Quinologist at Madras, has examined the bark and leaves of the tree with the result stated in the report to the Government of Madras (appended) dated 29th May 1872:—

Much has lately appeared in the papers and quasi-scientific journals concerning the valuable qualities of the *Eucalyptus globulus* as a febrifuge. In the *Lancet* for 20th April 1872 a notice is given of the uses of this tree medicinally, in which it is stated that all parts are most valuable as a febrifuge medicine, and also that the leaves when smoked are most efficacious in allaying pain, calming irritation, and procuring sleep. This article furthermore informs us that Professors Vanquelin and Leiciana obtained an alkaloid from the bark which crystallised like quinine as a sulphate, and which yielded the ordinary reaction of quinine with chlorine, water, and ammonia. I have examined the bark and leaves of the *Eucalpytus globulus* and have the honor to state that neither quinine, quinidine, chinchonidine, nor chinchonine is contained in the plant in any proportion.

The only precise instances of the removal of fever by the agency of this tree are those given by M. Gimbert in his paper, read before the Académie des Sciences, on which the numerous articles which have appeared in the journals lately have been based. The cases quoted are certainly remarkable if they can be accepted without qualification; but Dr. Hooker, on the other hand, says that he has failed to discover that the reputed virtues of the tree have any certain foundation.

However, without discussing the question of its febrifugal and antimiasmatic qualities, there can be no doubt that the *Eucalyptus globulus* is a very valuable tree. Its timber is excellent, very strong and durable. At the Paris and London Exhibitions the wood was mentioned in high terms as very suitable from its hardness and durability for various purposes, and especially for ship-buildings, as it resists the attacks of insects in the water. At the Paris Exhibition of 1862 the wood was recommended as well adapted for railway sleepers. M. Trottier, who has written a pamphlet on the cultivation of the blue gum in Algeria (where it is now largely grown), calculates that in eight years a tree would be sufficiently large to cut up into sleepers. In Australia the timber of the blue gum is greatly used by colonial ship-builders and by mill-wrights, carpenters, and makers of implements, as well as by engineers in the construction of works requiring beams of great span. Mr. Broughton reports that the tree produces a gum resin in considerable quantities closely resembling kino in its properties. He found it yield no less than 43 per cent. of tannin, and he thinks it probable that the gum would be found valuable as an astringent medicine. Its growth, as has already been said, is astonishingly rapid.

But if the reputation of *Eucalyptus globulus* as a sanitary agent cannot be confirmed, it will probably be advisable not to waste money in further attempts to naturalise it on the plains. There are many other species of the same family which, as natives of the hotter parts of Australia, will probably succeed perfectly in the plains of India. Their growth, like that of the blue gum, is rapid, and the timber of many (that of the *jarrah*, for instance) is excellent. The propagation of *Eucalyptus globulus* should be confined to those localities which are known to be suited to it.

Appended is a memorandum on the method of planting the *Fucalypti* by Colonel Morgan, Deputy Conservator of Forests in Madras, with marginal notes by Captain Campbell Walker.

Memorandum on the planting of Eucalyptus, by Colonel H. R. Morgan, *Deputy Conservator of Forests, in charge of Mudumallai, &c.*

The seed, which should be procured in January or February, should be placed in beds in rows 6 inches apart.

2. When the plants are 6 inches high, they should be taken up and placed 6 inches apart in beds; the roots should be shortened to 4 inches.

3. When 3 feet in height, the plants are taken up with a ball of earth round their roots, moss is bound tightly round the ball, and the plants are left in beds well-earthed up about the roots and watered till the young rootlets show through.

4. They may then be put out. April is the best month for planting, as the plants are then able to make strong roots before the monsoon.

5. When moss is not available, bamboo pots may be used, taking care to keep the large end of the joint for the top of the pot; the hole at the bottom to be plugged with grass. The plants should be placed in the pots when 8 inches in height, and left till they are 2 feet high, and the root shew through; then thrust the roots through, and the plant comes out with a ball of earth attached to the roots. Pits should be 18 inches cube.

6. In the second year it will be necessary to prune the trees heavily to remove all side-branches but the three pairs at the top.

Note.—I do not like to advance theoretical opinions in opposition to Colonel Morgan's *experience*, but I cannot help thinking this pruning might be dispensed with, and the trees left to nature.—C. W.

7. *Eucalyptus globulus* is best grown from 6,000 to 7,000 feet elevation; the red gum (*Eucalyptus rostrata*) from 5,000 to 6,000 feet; the jarrah (*Eucalyptus robusta*) (*marginata?*) from 4,500 to 6,000 feet. If the situation is very exposed, place your trees 4 feet apart in trenches 18 inches wide and deep.

8. In rich soils thinning may be necessary in the seventh year; in poor soils the tenth year. Grass land is best broken up by heavy ploughs, and if a crop or two of potatoes or oats are taken off it, the better for the plants. A tree of *Eucalyptus globulus* at twelve years of age in good soil will weight a ton.

Note.—I have seen plantations in which thinning was absolutely necessary in the sixth year. No rule can be laid down, as so much depends on soil and exposure, and the object for which the trees are grown.—C. W.

MINERALOGY.

The prospects of the Alpha Gold Mining Company are looking up. We learn that a wealthy firm in Bombay is disposed to invest a considerable sum in the efficient working of the mine. The crushings of the quartz obtained from this, which are now being made by the fortunate lessees of the Prince of Wales Gold Mining Company, are expected to yield a hundred ounces of gold!

A meeting of the Alpha Gold Mining Company was held on Thursday, the 24th January. There were about ten shareholders present. Dr. F. G. Shaw was voted to the chair. It was resolved that Messrs. Parry and Co. be appointed Secretaries and Treasurers of the Company at Madras, and the following gentlemen be invited to accept office as Directors, Messrs. John Miller, H. Cornish, Robert Orr, and Dr. W. H. Harris. The meeting expressed their conviction that, considering the splendid results shown by the working of the Alpha Reef by the Prince of Wales Company, which has indisputably proved the existence of gold in paying quantities, the time has arrived when active operations should be resumed on the Alpha. We believe that a re-action has set in, as regards the gold-mining industry in Wynaad. With the influential Board of Directors mentioned above, aided by Messrs. Parry and Co., as Secretaries and Treasurers, we trust soon to see that the Alpha Company is again at work, and, as we doubt not, with profitable results to the shareholders.

A report comes from Australia of the discovery of gold in New Guinea, and a rush thither is likely to ensue.

Mr. Hubel, the Mining Engineer employed by the Persian Government, has made an important discovery of silver near Zingam. He reports that he has found a vein of Galena of unusual thickness, containing in many places three per cent., and in all parts more than 1½ per cent. of pure silver. It is asserted that at a comparatively small outlay these mines may be made to produce an enormous revenue.

THE IRON AND COAL MINES OF WARORA, CENTRAL PROVINCES.

We drew attention, in our last issue, to the great success of the experiments which have been made in England regarding the manufacture of iron and steel from the iron ore, coal and lime of the Warora District, in the Central Provinces. Fifty tons of coal, thirty tons iron ore, and 5 tons of limestone were sent to England, for testing their value on a practical scale at established works. Our readers will remember the experiments which were made by Mr. Ness at Warora about two years ago. He heated the materials in a small blast-furnace (with cold blast), and though there was no difficulty whatever in reducing the iron to the metallic state, the impurities with which it was mixed consisting chiefly of the ash of the coal, which amounts to 33 per cent, could not be induced to melt and form a slag through which the heavier iron might sink to the bottom. Mr. Ness, however, was confident that good iron might be made, though he, no doubt rightly, thought that it would be better to try a totally different method of reduction. The Chief Commissioner fully endorsed this view, and, in order to test it, sent the above quantity of ore and coal to England, to be worked up, under Mr. Ness's superintendence, at some established iron works. In the ordinary process of making iron, an enormous quantity of coal is spent in heating the reduced iron up to its melting point; when melting, it combines with a considerable quantity of carbon and other impurities, forming cast iron; and to convert this into the malleable form, a further large expenditure of fuel, as well as of human labor, is necessary. The sole justification for the employment of this long and wasteful process, is the necessity of obtaining the iron in the fluid form, so that it may separate readily from the earthy impurities which the ore—generally clay ironstone—contains. Now the Warora ore being hematite, an almost absolutely pure oxide of iron, and the impurity coming almost entirely from the coal, Mr. Ness thought that if the ash of the coal were from the first kept entirely separate from the ore, good malleable iron might be obtained directly. Several forms of this direct process are now being worked on a practical scale in England, the principle of all of them being that of heating the coal on a separate grate, and allowing only its flame to come in contact with the ore placed on the furnace bed. Tested in this way, the Warora ore fully justifies Mr. Ness's expectations, for a spongy iron has been obtained, yielding over 93 per cent. of pure metal. The metal thus obtained has moreover been converted into steel, the result being unprecedented, both as to the cost of the manufacture, the time taken for conversion, and the quality of the steel produced. Twenty-nine pounds of metallic sponge were melted down by Mr. Hadfield of Sheffield in an ordinary steel melting-pot (presumably with a little charcoal), and in two hours 26lbs. of most excellent steel were obtained. This has been reported on by another firm of eminent steel-makers in Sheffield, and adjudged equal, if not superior, to the prize steel of the Philadelphia Exhibition. Both Mr. Ness and Mr. Morris, the Chief Commissioner, are to be congratulated on the very successful result of these experiments, which have been continued for several years now, under many difficulties and discouragements. Even if the spongy iron should prove unfit for working directly, which there is no reason to believe at present, the positive value of the discovery, that excellent steel can be prepared from it, must be immense. Should this result prove to be the only favourable one, the happy condition of the Central Provinces Government will be like that of Mr. Bessemer, who set to work to make wrought iron and failed, but in the process stumbled upon the method of making steel, which has rendered his name famous throughout the world, and made himself one of the richest men in England.

The Planters' Gazette.

TEA.

ADVICES from Assam say, that the pruning of tea plants is generally well advanced for the season.

RAIN is wanted in the Sibsaugor district for both tea and winter crops.

As near as can be judged from the latest accounts, it is calculated that the total quantity of tea available for export will be 32,000,000lbs. for the season, now closing.

EXPORTS to the United Kingdom during January amount to 3,547,092lbs. against 2,436,150lbs. exported last year.

CARRIT and Co. state in their circular, that the London Tea Returns were as follows :—

Imports—1st January to 31st December 1877, 31,882,000 ; 1876, 29,384,000 ; 1875, 25,615,000.

Deliveries—1st January to 31st December 1877, 28,013,000 ; 1876, 26,735,000 ; 1875, 23,314,000.

Stock—31st December 1877, 15,424,000 , 1876, 11,818,000 ; [illegible], 9,485,000.

MR. LIDDELL, a gentleman largely interested in tea, so informs us the *South of India Observer*, has succeeded in floating a new company at Glasgow. The capital of the company is £30,000 of which £17,000 represent the price of Mr. Liddell's tea garden at Neddiwuttum, estimated to cover 1,500 acres of which several hundred acres are in a forward state and ready for plucking. The balance of £13,000 will be the working capital of the Company, which is promised excellent returns, six per cent. in the fourth year, nine per cent. in the following two years, and larger profits as the estates age. We notice the formation of this Company as an indication of the estimation in which tea property continues to be held, notwithstanding the low quotations for the Indian article at the recent sales both at Home and in Calcutta. To Mr. Liddell the planting community is indebted for awakening interest and confidence abroad in investments of this description. Various reasons have been urged to account for the recent fall in prices of Indian teas. The London brokers and middle men have had no inconsiderable share in this result ; but while holding them not altogether blameless, we are of opinion that the tea planter himself must be credited with much of the depreciation. We cannot believe that a really good tea will fail to realize a good price. Carelessness in manufacture, resulting in a large admixture in consignments of burnt tea, has doubtless operated against the ready and profitable sale of Indian teas. The low prices and tardy sales of the last seasons crop ought to induce our planting friends to devote more attention to the various processes of manufacture by which they will be able to turn out a really first class article. Mr. Liddell's company will not probably be the only one that will be formed this year : others will come into existence ; and we hope that vested interest will bring pressure to bear on the Home authorities, and thus compel the Indian Government to remove the restrictions which it has thought fit to impose [illegible] the acquisition of land in Southern India.

A COMPANY has been formed at Macao to encourage the cultivation of tea. The gardens are to be placed under the management of Chinese.

THE great handicap on Himalayan teas, writes a correspondent of the *Pioneer* from the Kangra Valley, is the long land carriage to Calcutta. I heard not long ago a wild sort of rumour that traffic was to be opened through to Kurrachee, that is, to say, a system of through booking, which would not necessitate an agent at the railway terminus. Valuable as such a concession would be, of course while the market remains in Calcutta, thither must our teas go. Alluding to tobacco planting this correspondent says :—

"WE have lately heard a good deal about tobacco-planting. The chief difficulty lies rather in the dryness of the atmosphere in India, and for this reason we should fancy that some of the hill districts, with their local showers and accompanying moisture in the air are better adapted for the manufacture of tobacco than any other. Too much moisture is as harmful as too little. The former deteriorates and spoils the leaf, and the latter precludes the possibility of handling it. Tobacco at Kumaon has been grown at an elevation of 7,000 feet with remarkable success. Experiment in its culture are being tried in the Valley this year. I only hope a healthy hail-storm won't check the enthusiasm of those engaged."

TEA EXPORTS IN 1877. The following statement of tea exports from Calcutta for the year 1877, are extracted from the *Annual Exports Summary* :

"Shippers, Messrs. Begg, Dunlop and Co. 2,568,419lbs. Williamson, Magor and Co. 2,542,032 lbs. Schœne, Kilburn and Co. 2,199,782lbs. Balmer, Lawrie and Co. 1,740,129lbs. Barlow and Co. 1,616,620lbs. Macneil and Co. 1,586,239lbs. Duncan Brothers and Co. 1,515,134lbs. Simson, Griffitns and Co. 1,53,032lbs. Ralli Brothers 1,115,098lbs. Macknight, Anderson and Co. 1,104,113lbs. E. J. Stanley, Esq. 1,012,540lbs. Messrs. Octavius Steel and Co. 5[illegible]2,677lbs. Shaw, Finlayson and Co. 728,375lbs. Lyall, Rennie and Co. 520,623lbs. Mackinnon, Mackenzie and Co. 467,187lbs. Gisborne and Co. 462,426lbs. Jardine, Skinner and Co. 422,160lbs. Geo. Henderson and Co. 413,820lbs. Andrew Hoyes and Co. 406,007lbs. J. Mackillican and Co. 302,334lbs. David Sasoon and Co. 265,943lbs. Petrocochino Brothers 26,441lbs. Borradaile, Schiller and Co. 235,416lbs. Carlisles, Nephew and Co. 226,995lbs. Colvin Cowie and Co. 202,770 lbs. Gladstone, Wyllie and Co. 192,968lbs., Ker, Dods and Co. 186,428 lbs. Crooke, Rome and Co. 186, 290lbs. J. H. Fergusson and Co. 177,159lbs. F. W. Heilgers and Co. 173,509lbs. Bremner and Laycock 172,755lbs. Ede and Hobson 145,760lbs. Hoare Miller and Co. 136,811lbs. Young and Co. 136,790lbs. Agelasto and Co 125,440lbs. Jas. Sutherland and Co. 119,702lbs. Ralli and Mavrojani 108,698lbs. John Elliott and Co. 10[illegible],727lbs. Kelly & [illegible] 86,297lbs. Tamvaco & Co. 80,480lbs. [illegible]ner, Morrison and Co. 78,594lbs. Nicol Fleming and Co. 67,97[illegible]lbs. Other Firms, 4,430,441lbs. Total for U. K 30,582,627lbs. To Continent 4,660lbs. America 6,105lbs., Eastern Ports, &c. 199,[illegible]lbs., Austria 16,339lbs. Grand Total 30,803,625lbs.

THE latest official reports from Assam mention that rain was wanted for the tea, especially for the newly planted seedlings in Sylhet and D[illegible]rang, whilst there had been some showers in Sibsagur and Lackimpur which had done much good. There was a slight earthquake in Sylhet on the 5th ultimo.

THERE is every indication, says the Darjeeling paper, of an early tea season this year, but it is too soon to say positively that manufacture will begin at an early date, as it is by no means unusual for comparatively cold weather to set in February or March and check the flush.

FROM the same source we learn, that red spider has put in an early appearance at one of the hill gardens. Writing from the Kangra Valley a correspondent to the *Pioneer* says :—

"Signs of spring are beginning to appear, and the weather is decidedly warmer. The winter cultivation is, or ought to be, nearly finished, and March generally sees the factories being cleaned out and refitted for the spring flush. As a supplement to the returns of the Nassau and Holta Companies given in a former letter, I may mention that I believe the Kangra Valley Tea Company has turned out 47,000, and the Bijnath Tea Company 42,000lbs. of tea during the last season, so that our four largest gardens have totalled over three-and-a-quarter lakhs between them."

NEWS from Kumaon up to the end of January, says :—"The soil is now in excellent condition for hoeing among tea bushes, and if the season 1878 goes on as it has begun, the tea planters will have a bumper yield for 1878, to make amends for the deficient crops some of them had for 1877.

CHINESE AND INDIAN TEA.—That the use of Indian tea for mixing with China, says a correspondent to an English contemporary, grows on steadily and is deservedly making progress, no one acquainted with the trade will dispute. The business of tea cultivation in India is, however, still in its infancy, although in a few years it will probably develop into an enormous and permanently remunerative industry. Meanwhile, however, as the following figures will prove, it is at least premature to say that "the time is evidently not far distant when this country will be almost exclusively supplied by its Indian dependency." I see it remarked that "it is palpable that some unfavourable cause must be operating, to account for the falling off in the demand for Chinese tea." Allow me to assure you that there has been no falling off in the demand for China tea, but on the contrary the consumption continues to increase in a truly wonderful manner. The deliveries were 144,000,000lbs. in 1873, 149,000,000lbs. in 1874, 153,00,000lbs. in 1875, and 152,000,000lbs. in 1876. During the same years the deliveries of Indian tea were respectively 19,000,000lbs., 18,000,000lbs., 23,000,000lbs. and 27,000,000lbs. For the nine months ending October 31st of the present year, as compared with the same period in 1870, the deliveries of China tea show an increase of no less than 4,000,000lbs. This, I think, clearly shows that this branch of the trade is anything but a decaying one. The general excellence of Indian tea is unquestioned, and, if a high standard of production is maintained, its popularity will no doubt increase. A good many writers on the subject, however, appear to assume that all Indian tea is of superlative excellence, and that the China growths are more or less indifferent, the truth being that both countries produce good as well as inferior qualities, and every year many million pounds of excellent tea are imported from China, which realise from 2s. to 2s. 9d. per pound, without duty. This year the weather appears to have been exceptionally unfavourable for growth of tea, both in India and China, and the character of the China crop is doubtless, as a whole, below the average, but the same may be said of the Indian growths, as an exceptionally large proportion of the import is so deficient in strength and flavour that merchants find it impossible to realise the same, except at ruinously low rates.

THE PAST TEA SEASON.

MESSRS. MORAN & CO. say.—The results of the past season having demonstrated beyond doubt that the question of quality has at last become one of very grave importance to the Indian grower, no effort, it is hoped, will be spared in the future to produce teas of a high class. With the exception of a few Darjeeling and North-west marks, the teas which have been made during the past year, especially in Assam and Cachar, have shown, as a rule very inferior quantity as compared with those of previous season and coming into competition, as they have done, with vast quantities of common China tea, it is not a matter for wonder that prices have ruled low.

Unfavourable weather has been ascribed as the main cause of the deterioration; but we are inclined to think there has been a general tendency to pluck too freely in order to make quantity, and that in many gardens there has not been adequate withering accommodation for the increased incomings of leaf. But whatever the cause, the falling off in quality has been most marked, and has entailed great disappointment not only on the grower, but the shipper also, owing to the poor reception Indian teas have met with in the London market.

The production in this country having now assumed such large dimensions, the planter can no longer look for the high prices formerly paid, when Indian goods formed but an insignificant item in the total imports into Great Britain. He has to face the fact that he is now in actual competition with China, and that year by year, as the yield increases, buyers demands, as regards quality, will become more and more exacting.

It must not be understood however, that we recommend a rush to the opposite extreme in the matter of plucking; the leaf should be plucked moderately fine, and be allowed to grow out too long. What we should particularly urge is, that adequate tea-house space and labour force should be provided; the manufacture placed where possible, under specially European supervision, and increased attention given to the manufacture generally. We fear that, in the past, *natives*, in cases perhaps unavoidably, have been left in charge of work with which Europeans only can be entirely trusted.

The great and sudden downfall in prices has unquestionably given a serious check to the industry, further extensions, if any, must be gradual and made with caution, as there is no disguising the fact that supplies from all quarters threaten soon to severely test the demand. In reference to this, Messrs. Lloyd and Ceshire in their Tea market review for 1877 states as follows. "The year just closed has witnessed an important and serious decline in the price of Indian tea. It cannot be thought that this was unexpected, for it was evident long ago that it would be only a question of time when the production of Indian tea would altogether outstrip the consumption."

Fresh outlets, it is true, may in time be found for Indian sorts, which are as yet almost unknown out of the United Kingdom; but we have to deal with the present, and although the very low prices now ruling are stimulating consumption, yet imports still keep far in advance of deliveries as the subjoined figures will show:—

				lbs.
Total imports	1876	29,384,000 lbs.	Deliveries	26.735,000
"	1877	31,784,000 ,,	"	28,013,000

And the stock in London on 31st December last was 15,424,000 against 11,815,000lbs. in 1876.

Samples for Valuation Report—By-monthly samples should be despatched for brokers' report; and, in order that reliable valuations may be obtained, such samples should be a fair average of what the Garden has produced during the previous fortnight, not made up from one day's manufacture, nor specially prepared in any way; the leaf to be sorted in the same manner as it is intended to sort the bulk for market, and the percentage of each kind given: for instance, as follows:—

Name of Garden.			Date of manufacture.
Pekoe	...	...	say 35 per cent.
Broken Pekoe	...	...	15 „
Pekoe Souchong	...	...	35 „
Broken kinds	...	...	15 „

The musters to be packed in lead, well soldered, with an outer covering of tin or wood, and each to be about three ounces in weight.

Small Breaks—As these are now becoming a serious hindrance to business, and sell at comparatively low rates, it is manifestly to the planters' own interests to sort for as few different kinds as possible, especially in the case of small producing gardens: and we would point out that some unevenness in leaf is preferable to carefully sorted teas, when in lots of only 4, 6 or even 8 chests, inasmuch as such lots are seldom looked at by buyers. Breaks of from 30 to 50 chests best suit the trade.

INDIAN TEA AND INDIAN GRAIN.

THE Indian tea planters have, as a general rule, (says the *Dublin University Magazine*), been more fortunate in their relations with the Administration than the indigo planters. Individual cases of opposition are not wanting; but, on the whole, the tea planters have been let alone by the officials.

The consequence is that China is being rapidly beaten out of the field, and while the enormous amount of 24,000,000lbs. tea was exported to England in the year 1875, more than 28,000,000lbs. were sent from England to India in 1876. Every one who knows the difference is aware how superior the flavour and quality of Indian tea is to that grown in China and Indian tea is so far chiefly used by the trade for mixing with inferior China tea, and so bringing up the whole to the desired standard. Tea bids fair to become one of the most important articles of Anglo-Indian commerce, and the tea gardens situated on the slopes of the Himalayas are at an elevation, and consequently in a climate, more favourable to English life and health than most parts of Europe. Jute, again, has lately become an important staple, and over a million bales were imported into England in the year 1876. Hides and skins are perhaps the most valuable articles of export at present, requiring no personal labour on the part of the Europeans, and, indeed, no personal attendance beyond that of the agent or broker who purchases the hides, and, above all, requiring no investment or sinking of capital. The number exported to England in the year 1875 was 18,700,000, and in 1876, 20,400,000. So far, with the exception of grounds laid out as tea gardens and the ill-fated indigo concerns, no great amount of private English capital has been laid out and sunk in India. And this is exactly what India most wants. English money, so far, only passes through the country; it must do more before it can permanently enrich

Wheat ought undoubtedly to be one of the most important, if not the most important, article of export from India to England. In 1875 only 98,600 tons were exported, in 1876, 230,000. This rapid increase is hopeful; it shows what can and may be done; but even the greater quantity is not a hundredth part of what we might and what we ought to see. The fact is that grain is a bulky commodity, and cannot bear the expense of long railway journeys. From Cawnpore to Bombay is,964 miles, and the cost of sending one ton of wheat by rail is twenty-six rupees, twelve annas, or at par, say, £2-13s-6d. The freight from Bombay to Liverpool comes to about the same amount, and the ton of grain which is worth say, Rs 50 at Cawnpore has to be sold for something like Rs.150 at Liverpool to give a profit to the grower, the Indian buyer, the Bombay agent, the Liverpool agent, the Liverpool buyer, and to defray the various miscellaneous expenses which must be incurred in getting the grain from the field where it grew in the North-West Provinces to the mill where it is ground in Lancashire or Yorkshire. Cheap canal carriage to the coast would enable millions, instead of thousands of tons of wheat to be sent from the interior of India to Bombay and Calcutta, and shipped to England, at a price which would not only undersell Russia, Spain, and the United States, but would enrich India and enable England to depend only on her own possessions for her daily bread.

INDIAN TEA CULTURE.

ON Friday, February 2nd, 1877 Mr. A. Burrell read a Paper on "Indian Tea Cultivation:—Its Origin, Progress, and Prospect," at the first meeting for the season of the Indian Section of the Society of Arts. Colonel Yule, C. B., and a member of the Council of India, presided. Mr. Burrell, commencing with the efforts of Warren Hastings and others, attributed the first practical effort to grow tea in India to Sir Joseph Banks, who in 1788 drew up at the request of the East India House a memoir on the subject. This very important document, hitherto unknown, Mr. Burrell had disinterred, and quoted fully. Sir Joseph's recommendations were for the importation of plants from China, and the districts he pointed out as suitable were Behar, Rungpore, and Cooch Behar. He then described early but neglected notices of the indigenous tea plant being found in India by Gardner at Nepal in 1824, Moorcroft at Bissahir in 1821, Heber in Kumaon in 1824, by Dr. Buchnan Hamilton in Burmah and Assam at even an earleir date, and by Dr. Corbyn in 1827 in Arracan. But he attributed the first really practical discovery to Mr. David Scott, Commissioner for Assam, who in 1819 had sent the plant to Calcutta, supporting this allegation by the very specimen now preserved at the Linnean Society, Mr. Scott's letter sending it, and confirmation of his opinion by a letter he had received from Dr. McClelland, the sole survivor of the mission to Assam, in 1834, when the indigenous plant was finally decided to be true tea. Mr. Burrell then recounted the various steps taken by the Company—the appointment by Lord W. Bentink of the Calcutta Tea Committee of 1835 and its labours, the growth of tea in Assam in the North-West Provinces, the Punjab, and the South of India under the auspices of the Government, till they disposed of their plantations to the Assam Company and other private associations. The progress of tea culture was then traced throughout all the tea districts of India, especially in the North-West Provinces and in the Punjub, with many interesting details new to the public, of the remarkable success attained there, more especially of the advantages which the progress of tea cultivation had conferred on the natives. The remainder of the paper was occupied by a sketch of the prospects of Indian tea, in which the fact was pressed that India now produced, and was capable of producing, in any quantity, teas which were of a quality, strength, flavour, and purity, not only equal to, but superior to, those of China or any other country in the world, and which were adapted to all tastes, the plainest or the most fastidious—at prices, too, suited to the means of all classes. He urged those who heard him, in their own interests as consumers, and as a duty they owed to their countrymen in India, who had long toiled and struggled to meet their wants, without as yet any adequate profit on their investments, to a more direct and extended use of Indian tea, thereby affording a fair harvest of profit to its cultivators, for which nothing was now wanting but an increased consumption of their produce in this country. Then pointing out the very remarkable increase of the consumption of Indian tea in the United Kingdom—rising from 1½ million of pounds in 1862, or 1 per cent. of the total consumption to 13½ million pounds in 1870, or 10 per cent. to 21 million pounds in 1874, or 15 per cent. last year reaching nearly one-fifth, and bidding fair during the current year to be one-fourth of the total tea consumption of the whole of the country—quantities exceeding the consumption of the whole United Kingdom of 1837, and half of that so recently as 1854. Mr. Burrell concluded his exhaustive paper by some lively recommendations to the ladies and teatotollers, commending the use of Indian tea as the best, the most varied in quality and flavour, and even the most economical, considering strength as well as aroma, and urged the tea-planters of India to abstain from sectional disputes, and to unite in pressing on the public the fact that they now produced tea of all kinds perfectly adapted to English taste, and could, if need were, supply the whole wants of the country, independently of China or any other tea-growing country in the world. A lively discussion followed, in which many gentlemen connected with India took part. The paper appears in abstract in the *Journal of the Society of Arts*, but will immediately be published in full as a separate work.

THE ALTERED STATE OF THE TEA TRADE.

A CHANGE of a very important character in the nature of the trade, which has been gradually noticeable, has become latterly so much established as to deserve special attention. In former times, and indeed until quite recently, the amount of profit made by the native growers was so large that the fluctuations in the markets here were not sufficient to affect in any material way the quantity of leaf produced and sent forward to the markets. The season might be more or less profitable to the dealers; but the producers still obtained full rates for all that they could pick and prepare; and thus nothing on this side was sufficient to put an end to production in China. In consequence, as might be naturally expected, the markets in China were invariably against the foreign buyers. If the teas at home lost, the producers, and the country dealers could look philosophically upon fluctuations which still left them a handsome profit. As a result of this state of things, the Tea market, however disastrous its state might be, nearly always lacked the benefit of the reaction which ordinarily adjusts other overstocked markets: No cessation of production or shipment took place; and while the foreign merchant bewailed his losses, the up-country dealers accepted with perfect equanimity prices which though death to others were sport to them. Gradually, however, this state of happy independence on the part of the Chinese has become diminished, and there are signs that at last a healthier state of the tea trade may be anticipated from very unexpected causes. The excessive supplies from China, combined with the large importations of Indian teas, have had the effect of establishing a permanently lower range of prices. Common Congou, which formerly blushed to be below 10d. a pound has, until recently, shown itself unabashed at public sales at 7d., and other teas have fallen in proportion in their average and normal value. This result has not been brought about without much serious loss to the tea trade; but out of this evil, good of a permanent character is likely to arise. A point has, in fact, been reached at which the fluctuations in the market have begun to affect the producers and the Chinese dealers. We read in late advices that the natives have stopped bringing teas down to the leading markets; and a calculation will show that the range of prices which had become established in the markets here for the past two years is such that Chinese producers themselves will find it difficult to send teas to meet them without loss, it being well known by those Europeans who have travelled in the tea districts that ordinary Congou cannot be manufactured for the foreign market inside, 8d. a pound without loss to the producers the importance of this change, in its bearing upon the healthiness of the trade, cannot be over-estimated. The effect—which has in fact been already felt this year—will be that the production in China instead of continuing practically an unlimited quantity will come more into harmony with wants of the trade this side, and that a low market here will again have the effect of curtailing supplies, and will thus once more have within itself an element tending to rectify it. This feature in the tea market will be further increased by the competition with Indian teas, which have now become so thoroughly established as a staple article of commerce. There can be no doubt that they must always exercise a strong influence upon the ordinary run of blacks from China; while we find that some classes of teas from that country have already been completely ousted by their rivals from India. Green teas are now becoming a thing of the past in this market; and it is probable that China Teas will be affected in the following rotation by the increasing supplies of India namely:—

(1.) Green Teas.
(2.) Canton Scented Orange Pekoe.
(3.) Foochow Pekoes.
(4.) Tayshan Congou.
(5.) Red Leaf Congou.
(6.) Souchong.

In short, the probability is that only the Black Leaf Teas will be left to blend with Indian, unless indeed—as however it would appear too much to hope—the buyers in China will insist upon the producers making a tea which can hold its own against the Indian leaf. Still however, with those teas which they will not supersede, the Indian product will unquestionably continue to compete very severely, so that in fact we shall find that the days of the independence of the China Tea growers and dealers must in a short time be considered numbered. China no longer possesses any monopoly, and the profits which the producers there can make will be in future years much more dependent upon the prices that can be realised here than has hitherto been the case. Under such circumstances there is room to hope that the markets here will cease to be so much over-supplied as has hitherto been the case, and that if profits be not so large as they were (when they did occur) in former days they will be more regular, while on the other hand losses will be less severe and of less frequent occurrence.—*London and China Express.*

COFFEE.

COFFEE LEAF DISEASE.

(*To the Editor of the Indian Agriculturist.*)

SIR,—Coffee in Mysore being chiefly grown under the partial shade of forest trees, and having, a short time ago, observed that the leaves of some of these large shade trees were affected by a bright orange color fungus, to all appearance similar to the yellow rust so injurious to coffee, I collected some of these affected leaves and sent them home, together with diseased coffee leaves, to be submitted to Dr. Cooke for examination; this was done through Dr. Forbes Watson of the India Office, and as Dr. Cooke's interesting report on these diseased leaves may interest some of your readers, I send you herewith a copy of it, for publication in your journal if you think proper.

Coffee leaf disease, I am sorry to remark, is again showing up very badly on many estates in this district. This pest does not confine its ravages to any particular locality, but appears on coffee growing on exposed ridges, as also in sheltered valleys, on dry as well as damp soils, on coffee cultivated in the open, or under the shade of forest trees; it is all the same and there seems no exemption from it. All aspects and all attitudes are alike subject to the ravages of this pest. One remarkable peculiarity about this coffee leaf disease, which I have noticed year after year, but cannot account for, is, that patches of coffee, on an affected estate, are left untouched by the fungus, while bushes all round are suffering from its ravages. There is no accounting for this partial freedom of particular patches of coffee from the disease, when other parts of the estate are suffering from it, and it is not always that the same patch of trees escapes the fungus, what escapes one season may be attacked the following season.

It is unfortunate for planters that, no remedy has been discovered as yet for stamping it out this disease which has affected coffee for the last 8 or 10 years in almost every district. And although the affected leaves have been submitted for the investigation and consideration of practical and scientific men, yet, no satisfactory solution of the cause of the disease has been arrived at. Whether the disease is due to atmospheric causes, or is arising from some impurity, or defect in the soil, remains an undecided question, and so long as the real cause remains undiscovered, no remedy will be found for its prevention or cure. Our hope is, that it will die a natural death, and disappear as suddenly as it made its appearance.

The diseased leaves of forest trees, sent home by me, were taken from old trees, some fifty to sixty feet high Dr. Cooke and Mr. Berkly are of opinion, that the fungus on these leaves is of the "same family of moulds," as that which affects the coffee leaf. The one being only 4 to 5 feet from the soil, and the other 50 to 60 feet, should I imagine, enable scientific men to ascertain and determine whether the cause is atmospheric or in the soil. It is a matter for regret that neither Dr. Cooke nor the Rev. M. Berkly make any allusion of the cause, or even of the probable cause, why this fungus attacks the leaves of trees. Information on this point would be very valuable as it may lead to the means of discovering same remedy for preventing the disease from spreading and injuring coffee.

You have doubtless seen the "Report" on coffee leaf disease, to which Dr. Cooke refers. The suggestions made by him in that report, for the cure or mitigation of the disease, may be valuable, but could only be tried experimentally, and even if found successful, would not be practicable, as it is impossible to treat large estates as suggested by him.

My own experience is, that the severity of the coffee leaf disease can be greatly mitigated by high cultivation and a liberal supply of manure.

Mysore, Kuddoor district,
January 1878.

F. D. NUPPEN.

The following is Dr. Cooke's report referred to above :—

India Museum,
South Kensington,
April 4th 1877.

Dr. Forbes Watson,
India Office.

Dear Sir,—I am in receipt of a packet of diseased leaves from Mysore and extracts from letter of 12th December 1876.

The leaves were in three packets.

1. Coffee leaves with brown spots.
2. Coffee leaves with orange powder on them.
3. Leaves of forest trees.

I have examined all these leaves, and find No. 1 an early and undeveloped condition of the coffee leaf disease of which No. 2 is the full and mature development, *i. e.* the *hemileia vastatrix* of which details will be found in my report on "Diseased leaves of Coffee and other plants."

The paragraph in the letter above cited, which alludes to the packet No. 3, is to the following effect . "this season the disease is also affecting the leaves of forest trees."

A minute examination of the leaves of forest trees forwarded enables me to show that this judgment is inexact. The disease of forest leaves, although to the naked eye so similar to the coffee leaf disease, is nevertheless entirely different ; it is a fungus of the same family of moulds, but is not only a different species, but quite a distinct genus, and can have no relationship with the coffee leaf disease The globose smooth orange spores are produced on the tips of little spicules, which surround a globose hyaline head surmounting a thick cellular stem.

The structure is quite different from that of the coffee leaf disease. This disease of forest leaves is *œdocephalum aurantiacum.*

For further satisfaction, not so much of myself, as of your correspondent, I submitted the leaves to my friend, Rev. M J Berkly, who is well known every where, for his researches amongst diseases of plants, and he fully confirms my observations. He says, it is not only wholly distinct from the coffee *Hemileia* but, as he believes, the type of a new genus. A discussion on the same subject at the Scientific Committee of the Royal Horticultural Society, led to the same result.

It may be remarked here that the example offered by your correspondent of sending specimens of the infected leaves of the forest trees and not relying upon mere description, has enabled us at once to determine what the parasite is, and the example is one which it is hoped will always be followed in subjects of this nature.

I have no suggestions to offer on the cure or mitigation of the coffee disease beyond those contained in my "Report". Until those suggestions are proved useless, I have no others to offer.

M. COOKE.

SHADE FOR COFFEE.

SHADE has of late years become one of the necessaries in coffee planting in the low-lying planting districts of Southern India. It was first introduced by the European planter about the year 1867 or 1868, when the dreaded "white borer" made its appearance, and threatened to destroy the very existence of the planter. It was then that the subject of shade was first considered and attention paid to it, and those planters who were wise enough to give the matter due consideration and a fair trial succeeded in saving their estates from ruin : while, on the other hand, those who laughed at the idea have done so to their cost, as the many abandoned estates in the Bamboo districts prove.

The native planter, always planted under shade, though more with an idea of economy to save labor for felling the trees he left standing, than otherwise, but at the same time an idea of some scourge being prevalent among coffee, when planted in the open, seemed to have formed part of his reasons for so doing. Now that shade is cultivated on nearly all the estates of low altitude, the question is whether coffee thrives under every sort of shade, and what tree gives the best and most durable protection. Many have been the experiments tried, and nearly every tree has been cultivated with a hope, that some out of the many may prove successful. We will for a moment consider the virtues of a few of these.

The first, and one that demands most attention, is the "charcoal" (*Sponia wightii*), so called on account of its spontaneous growth after a jungle has been burnt—springs up like weeds and is very rapid in its growth, assuming the porportions of a tree, often 16 to 17 feet high in three years' time, and giving shelter to about 100 coffee plants—but it has its drawbacks as well, and never forms durable shade ; high winds snap the tops off, or it falls a victim to disease, and especially to a species of red "borer" ; it is also a subsoil feeder and soon exhausts the soil. It is excellent as a shade tree for four years or more, after which it deteriorates ; it should be lopped up twice a year, all branches separated close to the stem from the tree and just a few branches left above, when it presents the appearance of a large umbrella. The Jack (*Artocarpus integrifolia*) seems to take the fancy of the planter after "charcoal", but as a shade tree it is perfectly useless, taking 12 or more years to attain perfection, before which an estate might be twice ruined. And when full grown, the foliage is too dense, preventing the coffee plant from throwing out more wood and heavier crops. The enemies, too, against which this tree has to contend with are numerous. The wild pig "routs" all over the estate for its seed, when sown, and if fortunate enough to spring up, hare, deer, or cattle devour it, and to fence it when young would be most expensive. The common wild fig (*Ficus glomerata*), or better known amongst the coolies as "Atti", is by far the best of all the shade trees known, easy of growth and with very few enemies. After the first year, it assumes large proportions with just the quantity of foliage on it that coffee requires ; it sheds its leaves during the monsoon when they are not required and when it begins to get warm, puts on new leaves, and forms very good protection ; it can be easily planted in small stakes, a foot and a half in length, and a quarter to half an inch in thickness, at distances of 20 feet apart. When raised in nurseries from cuttings and transplanted out during the monsoon, it grows best. It has no enemies to speak of, and seems to luxuriate in the driest of seasons. Under its shade coffee grows remarkably well, and it is often to be found in the forest. When felling, care should be taken that it is allowed to stand and not cut down. There are many species of the fig common on estates, though coffee will not grow well under them. Conspicuous among these is the Sand paper (*Ficus asperrima*), and the Banian Fig, (*Ficus Indica*). The presence of these trees on estates is often the ruin of many a fine property. Jungle shade is also perfectly useless, harboring too often more birds and monkeys than it would be prudent to have on an estate during crop time.

Shade is cultivated with more than one object. It is well known that most of the districts, lying along the Western ghauts, are subject to long draughts, during which time, were the coffee plant under the direct influence of the sun, it would be scorched up ; and again the time that the "spike" is most forward, is the time when it is hottest ; and, were there no shade to keep the blossom firm and give the tree shelter, all the "spike" would be burnt. The growth of weeds, too, is comparatively small under shade, and thereby less expenditure is incurred in weeding, though at the same time we would advocate high cultivation and continual "hand-weeding."

The question whether shade has any effect on "borer" is one on which opinion is divided. It is certain that this "scourge" does not commit such ravages under shade as in the open, and it is not unfrequent to see "borer" visit estates under shade in a very mild form, while in the open the ravages it commits is something alarming.

While advocating shade on coffee estates of low altitude and where the rainfall is confined to the months of from July to October, we would on the other hand totally disapprove of shade being used at a higher elevation than 4,000 feet, or where the rainfall extends throughout the year and exceeds 40 inches. The Nilgiris, for instance, is a climate where shade would do more harm than good, but in some of the low-lying parts of Wynaad, now forming part of the Nilgiris, its presence is desirable. Too much shade is often used by some planters, and of any sort. This is a fatal mistake many planters make : heavy jungle shade of a suspicious character, often harbouring "borer", is allowed to stand on coffee estates when they are being opened out, the inexperienced planter often thinking that he is doing a wise thing—the result, however, proving to be contrary to his expectations. Felling "clean" and only allowing such trees as the wild jack, the mango, and wild fig to stand, is the best method that can be adopted ; six months after, the "charcoal" will spring up like weeds, and will answer the purpose, for which it is allowed to grow, admirably, till shade of a permanent nature can be established. The "charcoal" tree is easily removed when no longer required ; stripped of all its branches ; and the bark removed from the stem, it soon dies and gradually rots.

Shade judiciously planted in such districts where required will have the effect of saving many an estate from ruin, and we advise coffee planters to give this subject more consideration than it has received heretofore.

As our readers will gather from our article on "Shade for Coffee," a great deal depends on the nature of the shade trees used, and that, as a rule, the natural forest will not do. Some experiments made in Ceylon with the natural forest, at an elevation of about 3,000 feet, have been by no means satisfactory, the young coffee not prospering and the falling of the trees doing great damage. There is a large shade clearing on Hantanne estate, Ceylon, in some parts of which the coffee is very fine, while in others it seems to suffer from unsuitable, shade trees. Nothing, says the *Ceylon Observer*, refering to the estate, can be more pleasant to the eye and the feelings than the domain-like appearance and the cool shady walks through a clearing of this description. The great enemies to the shade coffee in the Hantanne district are wild pigs, which do a considerable amount of damage at times in rooting up among the bushes, and require the constant presence of a watchman. At lower elevations than 2,000 feet, we still consider that injudicious cultivation of coffee under shade is better than leaving it in the open. An interesting experiment is being tried in Dumbera, where the cacao plants, put out among the coffee, profit by the shade of the latter for some years, and then return the favour by shooting up and expanding into what is likely to be a beneficial shade for the coffee—a shade under which some of the worst weeds do not seem to prosper.

We are inclined to think that the use of cacao tree, to shade coffee, would answer exceedingly well in Southern India, and would bring in a large additional profit to the coffee planter. We have been collecting information on cacao cultivation in India for some time past, and trust, in our next number, to find room for an article on the subject.

THE following is a list of the principal Companies engaged in the cultivation of coffee in Ceylon, with the names of their Colombo representatives :—

COFFEE COMPANIES.

Ceylon Company, Limited	...	C. W. Horsefall, Actg.	Manager.
Uva Coffee Company	...	A. S. Burnett, Chief	do.
Spring Valley Coffee Company	...	ditto	do.
Hunasgiriya Coffee Company	...	ditto	do.
Vicarton Estates Coffee Company,		G. Wall & Co., Agents.	
Dimbula do. do.	...	G. H. D. Elphinstone,	Managing Director.

Taking 700 acres as the standard, the following are the names of all plantations exceeding that area in cultivation :—

LARGEST COFFEE PLANTATIONS IN CEYLON.

NAME.		PROPRIETORS.		PLANTED EXTENT.	
Hunasgeriya	...	Hunasgeriya, Company	...	1,850	acres.
Meddecumbera	...	Ceylon Coy., Limited	...	1,744	„
Diyagama	...	Dimbula Coffee Coy.	...	1,720	„
Spring Valley	...	Spring Valley Coy.	...	1,700	„
Delta	...	J. Boustead	...	1,600	„
Hangurankettee	...	C. H. De Sonza	...	1,160	„
Great Western	...	J. R. Hedge	...	1,159	„
Rothschild	...	Ceylon Coy., Limited	...	931	„
Holyrood	...	G. H. D. Elphinstone and W. H. Anderson	...	962	„
Uva	...	A. S. Burnett, Retti, & Morison		780	„
Norwood	...	Ceylon Coy., Limited	...	741	„
Gampaha	...	B. J. S. & H. T. Armitage	...	733	„

COFFEE, says a writer in the *Ceylon Observer*, cannot be a bad speculation, when a gentleman is able to retire, after twelve years' residence, with a sure income of £1,000 per annum. This is the good fortune of one of the well-known Thomases of Lindula.

A CORRESPONDENT of the *Ceylon Observer* thus discourses on leaf disease and manuring :—

"It is only when looked for that leaf disease can be discovered on the leaves, but a planter friend yesterday professed to find its germs in the bark of a branch. There certainly seemed to be an orange tinge assumed by the juice, and the gentleman in question stated that, under the microscope, the fungus germs are easily perceived in the texture of the bark. He had no doubt of the disease being in the circulation of the trees. If so, of course it must be met, and, if possible, overcome by applications to the feeding roots of the trees. We want something which will eradicate the fungus without destroying the trees. The heroic remedy adopted in the case of many vineyards in France is out of the question. We must, I suppose, just go on manuring, although with many it is true what a planter said to me:—'We are spending twice as much as we used to do in manuring, and getting half as much crop.' One gentleman, who has spent some £4,000 in manuring his estate (first removing the white grubs,—and he strongly deprecates the idea of leaving them to feed on the manure,) stated to me that the proportion of this sum paid for carriage was little short of one-half. At present carts can scarcely be got at all. So much as Rs. 50 for the 32 miles between Lorus terminus and Nawalapitiya, has been asked, and proprietors of estates who have attempted to dispense with the agency of Chetties have been sorely pressed for supplies of rice for their coolies. Every day proves more and more the necessity for the long-delayed railway, if the enterprise on which the importance and prosperity of Ceylon depend, is to be preserved from ruin."

A CORRESPONDENT writes from Southern India: "Prospects for the present year certainly look very bright. The copious showers towards the end of last year made up for past mischief, and news of bumper crops comes from most of the planting districts. It is asserted that the out-turn of coffee in Coonoor this year will be the largest the planters have yet had: and as to tea, land on the Neilgherries is being greedily taken up for the cultivation thereof. The trade in both enterprises between India and England is very healthy. In 1875-76, the exports of coffee from British ports rose from 311,831 cwts., valued at 1,305,334lbs. to 371,986 cwts., valued at £1,627,026. These figures, of course, do not include the exports from Travancore. The exports of tea were 24,361,599lbs., valued at £2,166,416, exhibiting a considerable improvement over the previous year, both as to quantity and value.

LIBERIAN COFFEE.

WE continue to receive, reports the *Ceylon Observer*, very favourable accounts of the progress of the cultivation of Liberian Coffee on Mausawa estate, Galagedara. Plants in all stages, from six months to five years of age, can now be seen on the property, and a nursery will shortly be available to plant out about ten acres. The crop of cherries now being picked, which was estimated at the rate of a ton an acre from the trees in bearing, is likely to give about double that result. Of course, it may be a question whether thirty or forty trees carefully looked after, can safely be taken as a criterion for the crop of 90 or 100 acres fully planted. But the margin provided by a ton or two tons an acre, it must be admitted, is ample to cover all contingencies. Messrs. Carey, Strachan & Co.'s manager is keeping a most careful account of the results of his experiments, the crop of berries being counted, besides measured and weighed, before the beans are placed in the nursery, for, as yet, every cherry produced is utilized for nursery purposes. Then, very properly, different trees are differently treated. One of the oldest has been allowed to grow to a height of twelve feet before being topped, and it is a very fine hardy specimen of what a Liberian coffee tree may attain to in Ceylon. One fact observed by Mr. Parrinton is the large size of the cherries on the younger trees: perhaps it is because they have fewer to mature, while, on those bushes loaded with the size of the ripe cherries is considerably less. An experiment with the plants growing in the nursery will probably be made at a somewhat lower elevation than Mausawa, in the neighbourhood of Galagedara. We have no doubt, too, now that Mr. Forbes Laurie has returned, the Liberian Coffee Company will be forming a regular plantation from their large stock of plants, while, on the land lately bought between Kurunegala and Polgahawela, Messrs, Leechman are to plant out a fine nursery of Liberian coffee which has been flourishing at Hultsdorf mills for many months back. Before the end of the present year, therefore, a considerable area ought to be under the cultivation of the Liberian plant in Ceylon. In this respect we shall stand far ahead of all the other countries experimenting with the new species, even if their planted acreage were added together. What British enterprise and capital can accomplish with the free and plentiful supply of good labour available here, may be judged from the fact that, although the cinchona experiment was commenced on a large scale by the Indian Government at three different and widely-separated centres in India—the Nilgiris, British Sikkhim, and Darjeeling—and every attention paid to it long before the cultivation was thought of in Ceylon beyond the Hakgala gardens, yet, at this moment, we have in the Island an area cultivated under cinchona, very nearly equal to the total extent in Northern and Southern India. In fact, Ceylon bids fair to be the greatest cinchona-growing country in the world.

But to return to Liberian coffee. There is one point on which fears are entertained, we think, very unnecessarily, namely, the commercial value of the new product. Various disparaging reports have bee received from the London market, and the low rate of 60s. to 70s. pe cwt. has been quoted for Liberian coffee, while some have actuall said it is undrinkable. The simple fact, no doubt, is, that the produc hitherto sampled has been gathered from uncultivated trees, and ver probably mixed with unripe berries. Mr. Agar informed us that h had the greatest difficulty in getting the Liberians not to pick unrip green berries for him even when trees twenty to thirty feet high wer covered with ripe ones. This shews us the usual practice, and we hav little doubt that there will be as much difference between Ceylo plantation Liberian coffee and the West African product, as betwee our fine plantation of the Arabian species and ordinary native coffee.

THE COFFEE STEALING BILL.

THE Hon'ble Mr. Hudleston has introduced into the Madras Legislative Council, a Bill to prevent Thefts of Coffee in Wynaad and th coffee growing tracts of the Presidency. The necessity for an Act o the kind has long been felt, and coffee planters have been loud in thei complaints of the great losses they experience, by coolies practisin systematic thefts of coffee, which they have no means of preventing.

The following is a statement of objects and reasons for introducin the Bill :—

The objects of this Bill is to check the extensive petty pilfering coffee on the part of coolies employed on coffee plantations in Wynaa and other coffee-growing tracts in this Presidency, which has been brought to the notice of Government.

2. The value of the coffee berry, and the facility with which it may be stolen and subsequently disposed of without detection, render special legislation necessary for the protection of owners of coffee estates.

3. Accordingly, the Bill provides—chiefly with the view of restricting the power of disposing off the stolen coffee, and thus removing the main incentive to petty pilfering—that within certain notified localities no person shall in any way deal in coffee, unless he shall have first obtained a license to do so from a Magistrate, who, however, is not to grant the license unless he is satisfied that the applicant is a fit and proper person to be licensed; and that every licensed dealer shall be bound to keep books and accounts, in which shall be regularly entered a true and full record of the particulars of each transaction. Penalties are attached to any breach of these provisions.

4. The Bill also renders punishable—

1st.—The dealing in coffee by any person other than a licensed dealer;

2nd.—The selling or bartering coffee to any person other than a dealer;

3rd.—The buying of green coffee from any other person than a licensed dealer or owner of a coffee estate or some person duly authorzed in writing to act for him;

4th.—The possession of green coffee by a laborer employed on a coffee estate, who fails to account satisfactorily for such possession;

5th.—The removal of coffee from any premises without the express permission, in writing, of the owner or his authorized Agent; such permission to specify the quantity, number, description, and marks of the packages, date of removal, destination and names of consignor and consignee; and

6th.—The gathering, removal, or loading or unloading of coffee on any estate between sunset and sunrise.

5. Provision is also made that in the case of persons convicted for the second time of the offences of buying green coffee from any other person than a licenced dealer and of being found in possession of such coffee without being able to account for the same satisfactorily, it shall be at the discretion of the Magistrate to substitute or add flogging for or to the penalties, provided by the Act, but that such substituted or additional punishment shall be awarded only as a punishment for the offence itself, and not as a penalty for non-payment of fine.

6 The Bill saves from its provisions—

1st—The purchase of coffee for purely private or domestic consumption from a licensed dealer; and

2ndly.—The receiving, carrying, or delivering of coffee by or to any officer or servant of the Railway Company in the course of his employment as such officer or servant.

7. Lastly, the Bill provides for the fees on licenses issued, and fines levied, under the proposed Act, being reserved for the purpose of furthering the objects of the Act, and empowers Magistrates to award, out of the fines realized, rewards to persons furnishing information leading to the conviction of offenders under the proposed law.

THE GOVERNMENT CINCHONA PLANTATION ON THE NILGIRIS.

REPORT FOR THE HALF-YEAR ENDING 31ST JULY 1877.

Number of Species.	Botanical Names.	Commercial Names	Number of Plants.	Value per lb. of Dry Bark in the London Market.
				s. d. s. d.
1	C. Succirubra ..	Red bark ..	1,215,963	2 6 to 8 9
2	C. Calisaya ..	Yellow bark ..	54,881	2 10 to 9 0
	C. Var Frutex ..			
	C. Var Vera ..			
3	C. Officinalis ..	....	..	..
	C. Var Condamenia ..	Original Loxa bark	1,193,159	11 7 to 15 8
	C. Var Bonplaudiana ..	Select crown ,,	87,509	
	C. Var Cripsa ..	Fine ,, ,,	4,355	
4	C. Lancifolia ..	Pitayo bark ..	279	1 8 to 2 10
5	C. Nitida ..	Genuine grey bark	2,786	1 8 to 2 9
6	C. Species without name ...	Fine ,, ,, ..	3,500	1 8 to 2 10
7	C. Micrantha ..	Grey bark ..	46,730	1 8 to 2 9
8	C. Peruviana* ..	Finest grey bark ..	3,389	1 8 to 2 10
9	C. Pahudiana ..	Unknown ..	425	..
10	C. Lanceolata-leaved var. of C. Officinalis ..	....	41,093	..
	Pitayo raised from imported seeds ..	....	35,844	..
	Pitayo plants brought out by Dr. Simpson ..	....	76	..
		Total ..	2,685,589	

Table showing the growth of the different species of plants planted out in the Plantation for the half-year ending 31st July 1877.

Number of Plants	Species.	Where planted.	When Planted.	Maximum Growth.	Average Growth.	Height of the tallest Tree.	Girth near the ground.
				inches	inches	feet.	inches
12	C. Succirubra..	Neddivuttum ..	30th Sept. 1862	7	3	35 7½	27
12	C. Officinalis ..	Dodabetta ..	Sept. 1863	6	4½	28	23½

Table showing the propagation and distribution of plants and seeds for the half-year ending 31st July 1877.

Date.	Total Number of plants propagated by cuttings.	Total number of plants permanently planted out	Total number of plants distributed to the public.	Total quantity of Seed distributed.
February 1877 ..	1,160	..	*Nil*	*Nil.*
March ,, ..	1,296	..	..	..
April ,, ..	1,370	..	3,300	70 oz.
May ,, ..	2,240	..	5,000	52 ,,
June ,, ..	1,140	..	50,000	48 ,,
July ,, ..	1,110	..	46,000	172 ,,
Total ..	8,316	..	1,04,300	342 oz.
Previously ..	2,677,273	1,190,458	3,365,447	591 ,,
	2,685,589	1,190,458	469,7473	933 oz.

Remarks.—The number of plants propagated during the half year under report, is 8,316, consisting of 1,860 plants of *C. Pitayo* and 6,456 plants of *C. Lanceolata.*

There was a great demand during the half-year for plants and seed. One lac, four thousand and three hundred plants, and 342 ounces of seed were distributed to the public. The amount of seed distributed during the half-year, is more than one-half of the total quantity distributed up to date.

Ninety-nine thousand three hundred and ninety-three pounds of green bark were collected during the half-year, and 13,500 pounds of dry bark were shipped to the Home market.

The season during the early part of the year was very dry, and the younger plants suffered. The growth of the older plants also was retarded, the maximum growth at Neddivuttum being 7 inches against 16 inches in the previous half-year. The weeding of all the plantations was carried out, and 17,000 plants in the Dodabetta plantation were manured with cattle manure.

AGRI-HORTICULTURAL SOCIETY OF INDIA.

THE Annual General Meeting was held on Wednesday, the 30th January, 1878.

The HON'BLE LOUIS JACKSON, C.I.E., *President, in the Chair.*

The report from the Council was read and adopted. The report enters first into the internal economy of the Society, shewing that, after deducting for deaths, resignations, and departures from the country, and allowing for elections during 1877, there is a deficit of thirty-two as compared with the previous year. Of the total number of all classes 130 are resident in Calcutta, 530 in other parts of the country, and 96 in Europe. The financial position is much the same as last year. The annual donation of Rs. 2,400 from the Government of Bengal has now ceased, as it was granted only for three years. A further application to the Government for the renewal of the allowance, or for State assistance in some other form is under consideration. The report then proceeds as follows:—

In regard to the garden it may be mentioned that the distribution of plants to members has somewhat increased, though the number of applicants is still smaller than might be expected. In addition to the privilege of indenting on the garden annually to the value of twenty rupees, it has been recently determined to allow members to purchase ordinary ornamental plants, in excess of the free allowance, at half price. Two hundred and forty-four applicants against 209 in 1876 received 7,972 ornamental rooted shrubs against 6,139 in the previous year; besides 429 bundles of rose cuttings and 50 bundles of cuttings of other plants, which is also an increase on 1876. There were 2,052 ornamental plants sold to members and others, and 1,612 fruit-grafts and seedlings, consisting principally of mangoes, peaches, and lychees, against 1,594 in 1876. Five hundred and eighty sugarcane cuttings were also distributed. The stock in the garden of all kinds (ornamental plants and fruit-grafts) has been steadily augmented, though a large part of the former consists of ordinary sorts, such as the Society is not often called on to furnish, and these plants will consequently have to be otherwise disposed of. The orchard which may be considered the most valuable portion of the garden, has, during the past year, received additions in stock plants, principally of peaches, lychees and pummelows, imported from China and Queensland.

The Council have again to tender their best acknowledgments to members and others for contributions of plants and seeds, including the Directors of the Royal Botanic Gardens of Kew, Calcutta, and Mauritius, the Queensland Acclimatisation Society, the Department of Agriculture, Melbourne, the Director of Agriculture and Commerce, North-West Provinces; Messrs. C. K. Hudson, C. Nickels, H. E. Abbot, and T. M. Francis. An interchange of plants has also been continued throughout the year.

Various subjects have come before the Society during the year, of which full particulars have been introduced in the monthly proceedings. Among these may be cited in this place the endeavours at improvement in the culture and manufacture of tobacco; the introduction of new kinds of potatoes; the attempts towards the introduction of Oregon and other descriptions of wheat; the satisfactory result of culture of Mangel Wurzel, and other field crops in Tirhoot; reports on blights affecting certain kinds of rice and jowar (*Sorghum vulgare*); the introduction of a new fodder grass, *Reana luxurians (Euchlæna luxurians)* and a new variety of cotton from Egypt, termed Bamiah. The Reana grass, it may be remarked, has taken kindly to the country, as evidenced by many letters from members who have been supplied with seed, and is likely to prove a valuable addition to our list of forage plants. It is an annual, but seeds most freely, and therefore the continuance of a crop annually may be confidently anticipated. The stalks contain saccharine matter and possess nutritious properties. It forms large tufts, where ample space is allowed for its development; a single tuft is said to be sufficient to supply an ox with food for a day. A quantity of seed has been recently gathered from plants raised in the Society's Garden, which will be fully distributed in due time, by the commencement of the rainy season. Seeds of the new variety of cotton (for which the Society is indebted to Mr. Chapman, Agent to the P. & O. Company at Alexandria) have been freely distributed in small quantities throughout the country, but the time has not yet arrived to report fully on the result. It may merely be remarked at present, that the report of its being a hybrid production between our "Dheros" (*Hibiscus esculentus*) and the Egyptian cotton would appear to be questionable, though the mode of growth certainly differs in various ways from the ordinary native and foreign varieties. The produce recently gathered partakes much of the character of *Gossypium Barbadense*. If however, it fulfils the expectation formed of it in respect to yield, &c., it will probably prove an important addition to our present stock of cultivated varieties.

Another and most important subject which has engaged attention during the year, has been that of blights of various kinds affecting tea plants. The Council are endeavouring to organize a full inquiry in respect to a thorough investigation of the several causes of blight, and have requested the co-operation of agents of gardens towards the proposed scheme. They have also obtained the kind assistance of Mr. Arthur Grote (a former President of the Society and one of its firmest supporters) to endeavour to ascertain if the services of a thoroughly practical Entomologist can be secured for the purpose, and on what terms.

From paucity of matter the Council have been unable to issue a number of the journal during the year, but they hope to be able to do so early in 1878.

The election of officers and Council was next taken up, and the following is the result:—

President.—The Hon'ble Louis S. Jackson, C.I.E.

Vice-Presidents.—Mr. S. H. Robinson, Baboo Gogendro Nath Tagore, Mr. W. H. Cogswell, and Mr. W. Stalkartt.

Secretary.—Mr. A. H. Blechynden.

Council.—Mr. R. Blechynden, Baboo Peary Chand Mittra, Mr. E. Broughton, Mr J. W. O'Keefe, Dr. S Lynch, Mr. H. J. Leitch, Mr. G. L. Kemp, Baboo Protapa Chandra Ghosa, Mr. E. Maclachlan, Dr. Geo. K g, Dr. J. B. Barry, and Mr. F. Eisenlohr

Mr. Eisenlohr's name was added to the Silk Committee; the other Standing Committies need no strengthening and remain, therefore, as in 1877.

IMPORTED APPLES.

Mr. S. H. Robinson submitted a few apples from a hamper full, he brought out in the *Khedive*. The large kind are known as the flat-nosed pippin, and the smaller as ribstone pippin in Devonshire, both being "keeping" or "store" apples there. and are kept through the winter months. Mr. Robinson adds—"I brought 60 in all packed lightly in the hamper, each in a separate piece of paper, three days before, we left Southampton on 18th December, and on opening them out here, six weeks afterwards, I found two only had decayed and four more were somewhat bruised, the rest all good and retaining their flavour fairly. They were in my cabin in the first two weeks of the voyage, and for the rest of the time were kept cool in the ship's ice-room but not frozen.

"I think this experiment is interesting, as showing it is quite practicable to import English fruit apples for this market successfully; at any rate during our cold weather months and without much trouble.'

MANGOES RAISED OUT OF SEASON.

Mr. C. Gregory brought to notice the fact that in a small garden on the north of the *dâk bungalow* at Bankipore there is a tree which ripens its fruit in December, Mr. Gregory forwarded one of these at the end of December, apparently of Bombay stock and of fine flavour. It would be interesting to learn if these trees are found in any other part of the country.

REANA LUXURIANS.

Letters, accompanied by packets of seed, were read from Messrs. A. Christian of Monghyr, P. Duff of Bhagulpore, and R. Nicholson of Mirzapore, regarding the above forage grass. Mr. Christian has found it to grow luxuriantly in the rains and is eaten greedily by cattle when green, but remains untouched by them when dry, that is, after the seed has been gathered. "I have not had much time to examine what the seed as a grain is fit for, but hope to do so in time; it is certainly an addition to our fodder crops and superior to the prickly comfrey which promised so much and has ended in utter failure." Mr. Duff states he has had 3½ seers of seed from three plants. "At this rate the grass will not be long in spreading over India. I intend sowing it largely next year. I have been asked by several friends for some of the seeds, and now think it will be generally cultivated for fodder for all cattle." Mr. Nicholson observes that the average height of his plants were upwards of 10 feet and very bushy. "I think it is by far the best forage plant I have seen. I have numerous applications for seed, and will distribute as much as possible."

EXPERIMENTAL TEA CULTURE IN THE ANDAMANS.

Read a letter from Major Protheroe, Deputy Commissioner of the Andamans, returning thanks for the assistance rendered him in obtaining tea seed for trial in the Andamans. The Secretary mentioned that through the kind aid of Messrs Begg, Dunlop, & Co., and Messrs Williamson Magor & Co., he had been able to obtain good China, hybridized and indigenous seed. The latter (Naga Hill seed), had been, obtained gratuitously through the intervention of the late Mr. P. S. Carnegy, the Commissioner of the Naga Hills, who had great difficulty in obtaining even so small a quantity as a maund, in consequence of its scarcity the in last season.

INSECT PESTS.

Letters were read from Messrs Lloyd & Co., sending a box of diseased tea plant cuttings for report thereon, and from the Sub-divisional Officer Burpeta, specimens of an insect termed Bhoer, which commits great depredations on mustard crops in Assam, and asking for a remedy.

COMMUNICATIONS ON VARIOUS SUBJECTS.

Letters were also submitted—

From the Director, Agriculture and Commerce, N.-W.-P., applying for Virginian tobacco seed for sowing in the Hills. Mr. Buck intimates that he has prepared a few acres to keep up a seed farm for supply of seed to the plains, Request complied with.

From the Superintendent, Government Gardens, Bangalore, applying for seed of the Bahmia cotton for trial of this new variety. Complied.

From Capt. H. B. Abbott, Political Superintendent of Jhallawar, requesting seed of *Reana luxurians* and mode of treatment. Complied.

From the Director, Oriental Museum, Vienna, requesting to be furnished with the publications of this Society, and offering to reciprocate. Agreed to.

From Dr. J. H. Ker Innes, Honorary Secretary, Simla Horticultural Society, applying for bronze medals for distribution at their periodical shows, Granted at cost price.

From A. R. Wallis, Esq. Department of Agriculture, Melbourne, returning thanks for a case of useful and ornamental plants.

From Baboo Peary Chand Mittra, a paper for the Journal on Bengal Rice.

From W. Knaggs, Esq., a paper on Tea Cultivation in province Wellesley.

A. H. BLECHYNDEN,
Secretary.

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"City of London"	...	3,212	McNeil.
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His Excellency General Sir Frederick Paul Haines, G.C.B.,
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„ Turkey	... ...	„	0	12	„
„ Game	... ...	„	0	12	„
Spiced Salmon	... (a great delicacy) ...	„	2	8	„
String Beans	... superior to French ...	„	0	12	„
Green Peas ...	... „ „ ...	„	0	14	„
American Ox Tongue, large	... ...	„	4	0	„
„ „ small	... ...	„	3	0	„
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THE INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. III.] CALCUTTA: MONDAY, 1st APRIL, 1878. No. 4.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb. 1876. R. KNIGHT.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

"PROTOTYPES" OF GARDEN VEGETABLES.

TO THE EDITOR.

SIR,—I send you the enclosed para. from an Indian newspaper, a stale bit of information, as all our kitchen esculents have descended from the Plants of *feræ naturæ*! The German traveller might have added other natives of the Himalayan ranges.—Mint, Penny Royal, Lavender, Rhubarb, Thyme, and some others.

In the S. African colonies, I found a very strong-smelling *Allium* (a real "wild onion") and a *Pastinaca* (a true jungle "Parsnip"), growing abundantly near wildernesses of the well-known *Physalis*; the latter pleasant fruit, too, I saw with other *Solanaceæ*, accompanied by the *Wild Potato*, on the highlands of the Union, in the Indian Ocean. I have grazed my mules on indigenous "Lucerne" about Kashmere. I think I can remember *Chive's Garlic* also, in their premature condition. All these *alliaceous* plants are the true medicine, the veritable *Materia Medica*, of wild and tame herbivorous quadrupeds, which all seem inclined to eat them instinctively.

Benares. W. H. L.

The following is the para. referred to:—

"The German botanist, Regel, has discovered in the Himalayas a variety of wild onion, which he regards as the original source of our ordinary garden onion. It is called *Allium cepa sylvestre*."

A NEW PLANTAIN.

SIR,—In looking over the article on the numerous varieties of the "Plantain," in the last number of the *Calcutta Agri-Horticultural Society's Magazine*, I do not see any description of a splendid species, peculiar to the Shan country, several days' march from the Suddya frontier, whence it was sent to me during my sojourn in Assam, many years ago.

Description.—Fruits, the largest of the whole tribe. Colour, lovely rose and peach-like; few in a bunch; high-flavoured, and perfuming a room with a scent of nutmeg odour; scarcely valued even in its own country. A Chief, on his return home, sent me two or three fine roots with an illuminated letter, flowery in its discourse and decorations. These much-coveted fruit-trees were stolen from my tea garden soon after planting. I hope they may have multiplied wherever they went, for I have never met with any plantain like those in all my travels.

W. H. L.

WHITE-ANTS AND SUGARCANE.

SIR,—Could you or any of your correspondents, kindly inform me whether there are any means of protecting sugarcane, when first planted, from the depredations of white-ants. Sometimes these pests eat up all the slips planted, before a single one of them has thrown off shoots. This is at least the case in Arrah and its neighbourhood, in the district of Shahabad. Could you recommend any work on sugarcane-planting, suggesting remedies to such pests?

A NATIVE.

20th March 1878.

NOTE.—To prevent white-ants from attacking sugarcane sets, the following mixture has been recommended:—

Assafœtida (*Hing*)	8 chittacks.
Mustard-seed cake (*Sursum ki khalli*)	8 seers.
Putrid fish	4 "
Bruised butchroot, or mudder	2 "

Mix them together in a large vessel, with water sufficient to make them into the thickness of curds; then steep each tip of cane in it for half an hour before planting; and lastly water the lines three times, previous to setting the cane, by irrigating the water-course with water mixed with bruised butchroot, or, if not procurable, mudder.

Another very effectual mode of destroying the white-ant is by mixing a small quantity of arsenic with a few ounces of burned bread, pulverized flour, or oatmeal, moistened with molasses, and placing pieces of the dough thus made, each about the size of a turkey's egg, on a flat board, covered with a wooden bowl, in several parts of the plantation. The ants soon take possession of these, and perish, while the poison is transmitted to their successors who feed upon them. They are said to be driven from a soil by frequent hoeing. They are found to prevail most upon newly broken-up lands.

In Central India, the penetration of white-ants into the interior of the sets, and their consequent deterioration, is prevented by dipping each end into buttermilk, assafœtida, and powdered mustard-seed, mixed into a thick compound.—ED., *I. A.*

BAMBOO AS PAPER STOCK.

SIR,—Your journal of the 1st January, has been sent me by a friend, this post, calling my attention to your leader on "Bamboo as Paper Stock."

Although I am unable to accept your "invite," to "come and verify your statement" in *propria persona*, I trust you will allow me space to do so in writing.

I agree with you that until a *fact* is realised, there are always doubters and "many reasons for doubting." I am also accustomed to having my "expectations deemed sanguine," but I venture to repeat my *conviction*, not "expectation," that "*cheap*" paper stock can and will be made from Bamboo, and that—"*it will pay.*"

I am quite aware, there are hundreds of square miles in India covered with coarse grasses. I am conversant with most of them, and have had many samples sent me here for experiment—so also there are hundreds of square miles covered with Bamboo, which by the way, *botanically* speaking, is the most gigantic of all grasses; but I assert boldly, as a practical paper-maker, that the coarse grasses (as generally understood) will not make paper to pay, and that Bamboo will.

Some of the grasses may be suitable for making paper in India, some of them indeed are, but only for the Indian market and for Indian *native* consumption ; but it is quite Utopian, to dream of bringing them to England, as neither in their raw condition, nor as converted into "stock," would they answer the requirements of the English paper-maker, who indeed has far better grass at command, *viz.*, Esparto, which also is far cheaper and far more readily treated, and will make a far superior quality of paper than any Indian grass.

When I tried to introduce Esparto to the paper trade first in 1856, I was met in the same manner as now, when I am trying to introduce Bamboo. "You are so sanguine ;" "it won't make paper ;" "it won't pay," &c., &c. In November of that year, I supplied the Society of Arts, by favor of their then and present Secretary, Mr. Peter le Neve Foster, with the paper on which their journal was printed, but *their* paper-makers would not believe ; and now that they are anxious to see Bamboo introduced into the market, recognising it as a superior material, I have the botanists against me. I doubt not however, that, by and by, I shall succeed in satisfying their doubts and scruples, as I satisfied the paper-makers, who only commenced using Esparto in 1861, while it has now reached an importation of upwards of 200,000 tons yearly—*magna est veritas et prevalebit.*

I send you a copy of my pamphlet, printed on paper, I made at our, Works here from "Bamboo", and will follow this, if you permit me with another letter covering a further communication from Mr. Thomson. on the cultivation of this, for us paper manufacturers, important produce.

CLAXHEUGH, SUNDERLAND,
27th February, 1878.
THOS. ROUTLEDGE.

NOTE.—Mr. Routledge has our best wishes, and we trust he will succeed in his enterprise. Having ourselves experimented with the Bamboo fibre, we knew what an excellent paper it could make before we saw samples of what Mr. Routledge produced, and which leave nothing to be desired. But while referring to the excellent quality of the paper, Bamboo fibre makes, we expressed our doubts whether the enterprise, *financially*, could be made a success. Our doubts were based upon information we received from various quarters. Mr. Routledge is, no doubt, a better judge on this subject than ourselves, and we should be glad to have our doubts removed. The enterprise with which Mr. Routledge has identified himself, is an important one, and we are as anxious as Mr. Routledge to see it established here in India on a firm basis, and have therefore kept the subject prominently before our readers in our last three issues, so as to elicit additional information from our correspondents. Regarding the coarse grasses, we mentioned as suitable for Paper Stock, we referred more specially to varieties found on the *churs* in the Soonderbunds and in the bed of the Brahmaputra ; we have seen very fine paper made from them. If Mr. Routledge desired to make some experiments with these varieties, we should advise him to address Dr. King for samples, &c.

Our columns will be open to Mr. Routledge for any communications on this subject. —ED., *I. A.*

A FEW NEW FLOWERS AND SHRUBS.

SIR,—I sowed some newly-imported seeds of the following plants in the end of October, and now give you the result :—

Romneya Coulteri—Every seed germinated, but the plants made no growth in the cold-weather ; they are now making a good start. It belongs to the order *Papaveraceæ*, allied to *Argemone verum, Sial Kunta*, and is of rare beauty at maturity (see illustration in Henderson's *List of New Plants*, 1876-77). Flowers large, snow-white, fragrant, 60 to 80 in a single specimen. I think it is a native of the mountains in South America.

Solanum pseudo-capsicum.—Round fruited variety, a beautiful decorative pot plant, like a miniature orange tree, *quite acclimated at Mussooree*, where it is to be seen at nearly every door ; for table centres, there is nothing like it. Every seed has germinated, plants are well grown and healthy, and are often mistaken for seedling oranges. Fruit elegant, but perhaps poisonous, being a "*Nightshade.*"

Perilla Nankinensis.—Did not succeed ; flowered well, when two or three inches high, in cold frosty weather ; evidently sown too late.

Anoda didyma.—Shrub of South America ; seeds good, and a number of strong plants are now doing well ; a very desirable, showy novelty ; flowers *scarlet*, according to description.

Pea-de-bouquet.—Sown rather too late, I find. The clumps were vigorous and of a fine green colour ; stems stout, and everything promising, as long as the weather was cold and frosty. A change came over my numerous plants with the hot sunshine and dry winds ; the tops became thin and straggling ; the bunches of pink and white blossoms weak and dwarfish ; no scent in them ; in fact, they are all sickly.

Mandevillea suaveolens.—Climbing shrub of South America. Every seed germinated, and I have a box of fine healthy plants full of leaves. This is one of the gems in South African gardens, flourishing in arbours in the hottest summers.

Calampelis scaber.—Every seed good ; a bignoniaceous climber of South America ; one specimen is now putting out a long shoot ; seems to be quick-growing.

Centaurea Americana Ilalli.—All growing with healthy spreading foliage ; described as the finest of the tribe, with rich purple flowers.

Anchusa Italica.—A number of fine spreading plants ; seem to dislike hot dry winds prevalent just now ; one in a sheltered pot is untouched ; those in the open border are slightly "scarred." I prefer for India that lively South African weed *A. Capensis*, a tall kind of Forget-me-not, blooming on open ploughed lands in spring.

Myosotis sylvestris.—Every seed good ; some nice clumps in a damp shady border ; a *rat hole* in the water-course, seems to keep the roots always moist and the foliage perfect. Of 3 or 4 other species received, not one seed showed above ground. I grew *Myosotis Palustris*, our common *Forget-me-not* of Britain nicely in Bengal round the edge of a large sized pan, sunk in the border and always filled with water, in which were 2 or 3 kinds of *Nymphæa*—a charming bit of ornamental gardening, being a blue circle, enclosing many colours.

Chrysanthemum Burridgenum.—A very handsome new variety flowering well with many other kinds ; concentric circles of colours make *C. B.*, very like a "gay cockade" !

Richardia (*Calla*) *Æthiopica.*—Pig's lily of South Africa ; every seed up, and plants thriving ; a *semi-aquatic* plant ; grown round a pan as above.

Heliotropes.—Mixed varieties ; every seed germinated, and I have a large box of tall healthy specimens about to show their flowers.

Ipomopsis.—Two kinds ; a very lovely annual, but difficult to grow well ; only succeed in pots ; beware equally of *damp* and drought, and *never transplant.* I have studied this beautiful plant and have not lost *one* this season ; *cuphœus* good, but *enuneus* is not so handy as the others ; all alive, but not growing fast, though the others have been long in flower ; do not transplant. Pot or border equally good.

Eutoca vescida.—Growing like a weed in the borders, fresh rich blue flowers, out daily.

Nemophilas.—All very abundant, but flowers diminutive in this long, dry gardening season of 1877-78, and my well, a brackish one (bad for flowers), is drying up fast, and so the garden too !

Mentzelia ornata.—Described as of wondrous beauty for size and shape of its flowers ; native of South America ; all germinated, but seem inclined to linger. It might do better in Upper Bengal.

Guillandias.—Some of them new kinds, filling the beds with promising clumps.

Anotheras.—Many kinds ; several novelties ; all, except one packet, are doing well ; famous hot-weather flowers, I have always found them liking dry winds.

Arctatis breviscapa.—Pretty South African weed, flowering now gay in a mass ; *likes dry soil and climate.*

Callirhoe pedata compactanana.—Growing well, but should have been sown earlier.

Hebiscus Africanus.—Flowering abundantly ; same remarks on sowing.

Salvia Patens.—Two fine plants, the first I ever managed to raise from seed, which is uncertain. I brought "roots" of it with me from Mussooree, where it attains great beauty as an indoor plant.

Palana flexuosa.—All germinated ; a few came to full size and flowered both in pots and the borders, but all damped off suddenly ; seemingly cold dews and moist winds were the cause ; sown at an earlier period it may do well here ; a graceful plant, suited to ornamental indoor use.

Hollyhocks.—Many kinds of prize English and dwarf Chinese, are all thriving and rising up under the hot sunshine of this season. I find them very desirable plants, and they make a great show here, when nearly everything else has faded. I use soil 2 feet deep, consisting of decayed vegetable refuse, with a certain allowance of old rotted stable and cow manure added. A *soaking* irrigation given to this compost keeps it like a *wet* sponge (during dry weather only). The rains here are very hostile to hollyhocks ; their roots rapidly perish at that season. In the dry temperate climate of South Africa, they attain great perfection even in cottagers' gardens.

Schinus Mulle.—A weeping shrub of South America. I raised three from a large packet. Thrives at Bangalore and Ootacamund;

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W. H. L.

Benares, March 4th, 1878.

CHRONIC POVERTY OF THE AGRICULTURAL CLASSES.

I.

TO THE EDITOR OF THE PIONEER.

SIR,—There can, I fear, be little doubt that there is a considerable amount of distress amongst the poorer classes in many districts of the N.-W. Provinces, Oudh, and even the Punjab. It appears to me a grave and suggestive fact that there should be this distress on such, (apparently) slender grounds. Consider, that up to last autumn these provinces have been favoured with excellent harvests for several successive years, and that, thanks to the railways and good roads, there has been a ready sale for all surplus produce. Yet the partial failure of one single harvest, and that the less valuable one of the two, at once places large numbers of the population on the verge of starvation. How is it that the people are thus living from hand to mouth? Surely it is not creditable to our rule that, in spite of the increasing wealth of the country, the mass of the people derive little or no benefit from it. I submit that if the new Famine Commission will take up this among their subjects of inquiry, they may do very great good. We know of course that the people are improvident; and we are everywhere told that the agricultural classes are always in debt to the bunniahs, and that the latter alone reap any benefit from the rise in value of agricultural produce. But if this is so, *why* is it so? Can nothing be done to remedy it? No civil officer of whom I have asked the question can give a satisfactory answer. The officials appear helpless in presence of what every one admits to be a great and growing evil—*and one which is directly attributable to our rule.* Some allege that our courts of law are in fault; that they give every chance to the astute moneylender, and none to his unfortunate client. Others say that if the land-revenue was taken at different periods of the year from those now in force, the payment of it would be easier. Others again assert that the present hard and fast rules of assessment are altogether wrong; that the whole theory of the State's proprietary right to a share of the gross produce includes the assumption that the amount of that share should vary with good and bad years, that the State is forced to act upon this in very bad years by having to remit a large part of its demands; and that, if the principle was admitted, it could recoup itself in good years by taking a larger share.

I have myself no theories to maintain on the subject; but I confess it appears to me a very grave and important question, and one in which very serious results are involved. Of what use are our railways, jails, dispensaries, schools, and other essentially British institutions if after 50 years of our rule, the mass of the people are no better off than they were before? If the fact is denied, in spite of the present distress which seems to me, however, to be pretty strong evidence of it, take the following extract from the last census report of the N.-W. Provinces —"At a distance from towns, the ordinary wage of an agricultural labourer, almost invariably a married man—I refer more particularly to the Allahabad district—is, in the ploughing season, one seer nine chittacks (equal to 50 ounces) of *behjur* (a mixture of grains) When digging and weeding he gets about two-thirds of the above quantity. The wife is also occasionally employed in light field work and when so engaged she get from 25 to 30 ounces of *behjur*. The husband, in addition, receives about *two rupees, either in coin or its value in grain, once a year* from the zemindar as a retaining fee. *The above constitutes the highest daily earnings* of man and wife when in regular work, but during the hot season, and occasionally throughout the year, field hands are not required and the family subsist on the irregular earnings of the husband while employed in repairing houses, &c, in the village. Should the husband become sick, no rare event, *absolute starvation stares them in the face.*" (The italics are mine.) That report was written five years ago. Has anything been done to remedy such a state of things? Among other schemes, I have heard it suggested that Government might try district savings banks, which should receive deposits and make advances on terms somewhat less exorbitant than the village moneylender. The only reason I have heard against the proposal is that, in case of recovery by distraint, the State would incur the odium which now falls on the moneylender. I doubt very much whether the State does not incur the odium as it is, with the knowledge that civil officers constantly experience, when enforcing the law, that they are really being made the instruments of tyranny and roguery. However, I only propose that the question should be faced; for if the general result of our rule is that large masses of the people are simply living from hand to mouth, and in such a state of poverty as that described in the above report by a responsible Government official—and if there is no cure for such a state of things—the sooner we take ourselves out of the country, the better, and let the Russians or some one else try their hands at the task of governing it.

VERITAS.

II.

SIR,—During an active life of twenty-three years in India, I have been brought in almost daily contact with the agricultural and other poverty-stricken classes of the country, and have found, as a rule, that the village bunnia was at the root of all the evil. I have scoured the land between Madras and Lahore, and between Bombay to Calcutta. I have been independent of the Government, and also in its employ in the Revenue, Survey, Settlement, and other Departments; and I have thus had grand opportunities of picking up various vernaculars, and the advantage of conversing with the people of the country in their own language. The tale is one and the same everywhere, *viz.*, hopeless indebtedness to the village bunnia. The land assessment is not heavy As a rule, I have found, from personal observation and experiment, that the price of the stalks and straw of corn is actually sufficient to cover the land tax. Grain produces fifty per cent. on an average, and an ordinary ryot seldom employs labour other than that of his own family, hence, properly speaking, he should live in ease, comfort, and happiness. But he does not. His father's debts have descended to him. He has no capital: in fact, starts in life involved, and has to depend upon the bunnia for food and clothing, giving up his crops in payment. The bunnia is doubtless an essential element in village economy. But his accounts are an altogether one-sided affair. The one is up in his figures, sharp and grasping; the other needy, confiding, and ignorant. The ryot has not the means of overhauling his banker's account, and has either to submit to his statement of them, or suffer his wife and children to starve. Surely this is a distressing state of affairs. That we should have held the country for a century and permitted such a wrong to be inflicted on a humble, but loyal class is painful to contemplate. It is the rich, well-to-do native that has law, comfort, and prosperity on his side. What legislation has been made by us in the country, appears to be in favor chiefly of those living in towns and trade centres, leaving the mass of the people almost unnoticed. What we want is a law that will stop for ever this unlimited lending and borrowing that goes on. Let the moneylender feel that he can advance to a man only to the extent of his income for six months, and that he will be protected by law only so far. All sums that he may advance in excess of this limit, he advances at his own risk. Let the ryots, our domestics, and all labouring classes understand that they cannot borrow in excess of this amount, and it will check at once their extravagance, and make them both careful and free. The ryot is a loyal, grateful man. It is only your half-educated, English speaking native, who, dropping his own native title, will contend to be Mistered or Esquired, and will set himself up to criticize and villify the acts of a Government, that has done all in its power to civilize him. The ryot is manly and yet humble, and looks to our Government as a protective, paternal authority. Let the Government then put forth its power, respond to the confidence reposed in it, and act so as to ensure for ever the ryot's happiness, gratitude, and loyalty.

EXCELSIOR.

PANICUM MILIACEUM OR SAWA.

TO THE EDITOR OF THE PIONEER.

SIR,—While political economists are puzzling themselves to find remedies for famine, let me draw attention to a very useful food-grain which it is not generally known can be grown almost throughout the year, in these provinces at any rate; and from the time of sowing can be harvested in about sixty days. I mean *sawa*, or *Panicum miliaceum* (or *Pilosum*, a millet, *Roxb.*) much used by the poorer classes in Eastern and Central Oudh. Our experiences of *sawa* at Roy Bareilly during the past season of drought, are as follows:—In July and August, when the *khurreef* crops failed, and all hands were pressed by me to sow a belt of any food-producing grain round every well, a large area of *sawa* was sown which yielded a good outturn in November-December. In January, when field labour was becoming scarce, we again pressed the people to sow more *sawa*, and a further large area was then put down, mostly in the lands where frost had ruined the *urhur* crops, as a means of supplying labour as well as food. This will be harvested with the *rubbee*. Lastly, in February, the normal season for sowing *sawa*, an unusually large breadth was again put down, so much so, that the saying amongst the people now is, "we lost our *khurreef*, but we are going to recover it in May." There are three kinds of this useful grain usually grown in Oudh: (1) *maghi* (January-February) or *ujli* (white), which is also called *churkua, china*, and *chainowa*; (2) *juittrua* (May) or *lollia* (red); and (3) *bhadela*

(August-September) or *dhainria.* The first and second of these can be sown in almost any month of the year, and have a single husk, but the third is sown in *Asarh* (June-July) only, and has a double husk. In Tamil this grain is known as *kata cunni* ; and in the Deccan, *warri.* It requires eight Government seers of seed to sow a standard beegah, and that usually sells at 2 or 3 annas, but this year it has been costing from 12 annas to a rupee. The yield from the two first kinds mentioned, which are sown in highly manured and irrigated land (saline soil being specially favourable to it), is 20 to 30 maunds per beegah, while the last kind mentioned only yields 12 maunds. In the cold season, four or five waterings are sufficient ; but in the hot weather at least twice that number are required. Innumerable *kutcha* wells have been dug during the late drought in this division, specially to irrigate it ; but without much attention and labour the hot weather crop is uncertain, so much so, that the natives have a proverb about it which says that "irrigate it as you will, a hot blast may wither it." The husked seed, called locally *sunwari,* is boiled and eaten with milk, like sago and ground rice, or with vegetables, and it is also ground and made into cakes mixed with the flour of other course grains. It is very satisfying, and as food a little goes a long way. During a long official connection with the people, nothing has surprised me more than the apathy with which they saw hunger approaching during the last monsoon without making any effort to avert it. People who at other seasons would work 18 out of 24 hours without a murmur, would not at first move a hand to save themselves from certain want, because their forefathers had never irrigated the *khurreef,* and Heaven would yet send rain in time to save their trouble! This was the line they took ; and it was not till August, when official pressure was brought to bear indirectly upon them, that at last they began to make an effort to irrigate and sow. The lesson we learn from all this is, from the prevention of famine point of view, a most important one : in future seasons of threatened drought, the sooner the people are reminded of their obligation to support themselves, the better.

Rey Bareilly. PATRICK CARNEGY.

The Indian Agriculturist.

CALCUTTA, APRIL 1, 1878.

TEA-PLANTING AND MANURING.

THERE are now, we trust, very few of our planting friends who will not readily admit, that to obtain continuous harvests, they must resort to continuous manuring. This has been so fully discussed in our own and our contemporaries' columns, that there cannot remain a doubt on the subject, in the mind of any one who has given a little attention to it. But though there are now very few coffee planters who not only readily admit the necessity of manuring, but also the fact that the additional outlay incurred by it, gives a handsome return in the additional yield—tea-planters in Upper and Eastern India are, as yet, groping more or less in the dark, and whether extensive manuring will pay them or not, is a question which they do not consider by any means settled.

In the sparsely populated tea districts, it is almost impossible to obtain locally any manure suitable to the tea plant, and in consequence, on more than 90 per cent. of the estates that have been yielding an annual outturn per acre of from 3 to 4 maunds of tea for the last ten or twenty years, there has never been any systematic use of manure. These estates can only procure manure from long distances, from Calcutta and elsewhere ; and it is not an excessive estimate to calculate that the cost of bringing a moderately priced manure to tea estates in Assam or Cachar, will nearly double the original price of it. This expense, we believe, has deterred tea planters from, as yet, resorting to an extensive use of imported manure and the data we possess, showing that imported and moderately priced manure does pay, notwithstanding the long distances it has to be carried, will perhaps be considered insufficient to thoroughly convince the many unbelievers. Supported however by the experience of planters in Ceylon and elsewhere, where carriage of the manure from seaport to estates, is quite as expensive as it would be from Calcutta to Assam, we have no hesitation whatever in saying, that, if it pays planters to grow and manufacture tea in Assam and send it to Calcutta, it will likewise pay them to purchase a suitable and moderately priced manure in Calcutta and send it up to Assam.

There is no mistaking the evidence which we have been receiving, for the last two or three years, from the older tea districts ; it proves, that the time has come when tea planters in Northern and Eastern India will have to make up their minds on this great question of manuring their estates. The issues involved lie in a very narrow compass.

All soils recovered from Nature, or all so-called virgin-soils, contain a certain superabundance of available plant-food which has been stored up by Nature by a tedious process of disintegration and decomposition, extending over hundreds of years. These soils, cultivated for the necessities or luxuries of mankind, will yield a certain number of crops annually, without it being necessary to restore the elements of plant-food withdrawn from the soil, and without any diminution of the quantity of produce. The number of crops which thus can be obtained, depends upon the original richness of the soil. Some soils will bear continuous cropping, without it being necessary to manure, for five years, some for ten years, some for twenty years, but very few for a longer period than that. The produce of the land which is obtained during all these years represents the stores of available plant-food which Nature had accumulated in the soil. Once this store is exhausted—and experience in America, Ceylon, and other countries, where virgin soil has been systematically cultivated, has shown that ten to twenty years suffice to utterly exhaust it—the yield commences to decline, and depends henceforth on the quantity of plant-food, set free annually by the action of water, heat, and atmospheric air. This quantity, set free, is however so small that the yield soon falls below that limit which pays for the labour expended in the cultivation of the soil. (We take here only the more expensive crops into consideration. In the case of cheap crops, like rice, millet, etc., growing on an exhausted soil, the quantity of plant-food annually set free by natural forces, seems to be sufficient to give, in favourable years, a yield which enables the ryot to exist.) These being the main principles, the issues which remain for consideration by the tea planters are :—

1*st.*—Will it pay better to stimulate the soil to its utmost capabilities without using manure, endeavour to obtain as many large yields as possible, and then abandon the land as soon as the return ceases to be profitable ? or,

2*nd.*—Will it pay better to adopt a system of continuous manuring, which would enable the planter to obtain indefinitely. remunerative harvests ?

Now we would ask tea planters to consider these two issues well—there is no middle course. Either use no manure, and then the soil must be stimulated so as to yield both capital and interest in as short a time as possible, so that cultivation may be abandoned without pecuniary loss, when the soil ceases to give remunerative harvests ; or use manure, and thus obtain the highest possible interest from the capital, represented in the soil of the estate. We are certain there will be very few planters, who will hesitate which course to adopt, and we are equally certain that there are still fewer, if any, who ever entertained the idea of getting as much out of the soil of an estate as to be able to abandon it eventually, or who would make up their minds to do so, even if they thought it might pay them better.

But the time has come when we must make up our minds, to adopt either one course or the other ; for there are unmistakable signs that in most of the older tea estates, in Assam, Cachar, and other tea districts, the stores of available plant-food above referred to, have been used up. There is no surer indication of a plant being in want of suitable or sufficient nourishment, than when it begins to look sickly, and succumbs to the ravages of vegetable and animal parasites, comprised in what is generally called blight. Whenever, therefore, a tea garden arrives at that state, we may safely assume, that the natural resources of the soil are exhausted and must be supplemented by manuring. But the injurious effects of insufficiently nourishing tea plants, are not confined to the prevalence of blight and a diminished outturn per acre; they influence the whole tea industry, if these badly-nourished plants are allowed to seed and the seed is sold for new plantations; for the seedlings inherit, what has become a chronic disease of their parents, and require double the usual care to bring them up. A healthy stock will always produce its healthy kind, and *vice versa.* The isolated instances therefore, where quite young tea plants, growing on virgin soil, are attacked by red spider and other blight, do not, in our opinion, contradict the theory that the absence of sufficient mineral plant-food in the soil, is the primary cause of rendering the plant liable to be attacked by the red spider and similar parasitic blight. In all these cases the diseased state of the young plants can be traced back to diseased parents, and it is irrational to suppose, that the planting of diseased seed in virgin soil will remove at once the injurious influence of its parent. Sickly parents, as a rule, have sickly offsprings, which not only require more [illegible] and more nourishment than healthy offsprings, but will at no time equal the same in strength and other qualities. Selection of seed is one of the fundamental principles on which successful agriculture is based; and in selecting tea seed, we should make sure beforehand that the garden from which we buy has been free from blight for at least three or four years. While we are writing on this subject we may opportunely refer to the bad practice of taking seed from tea plants which have, for years, been regularly plucked for tea. It is impossible that such plants can yield good seed, or seed which would bear comparison with that from plants, the leaves of which have never been plucked. The superior qualities of seed from plants which have never been forced to throw all their strength year after year into the production of young shoots, would be so apparent that it would pay any planter to set aside a portion of his garden, exclusively for seed, and this portion should on no account and under no circumstances be plucked.

THE questions now arise, in connection with newly-established tea gardens, when does it become necessary to manure these gardens? how many years will they bear cropping without manure? and is there any advantage in manuring virgin-soils?

As stated above, every virgin soil contains a certain excess of available plant-food, which it is quite safe and legitimate to make use of, and we would therefore crop a rich, loamy virgin-soil for four or five years, without using manure. (We refer, of course, specially to tea, as there are many other crops of so exhaustive a nature that their continuous growth for even only two or three years without manure, would suffice to temporarily exhaust the average virgin—soil of Assam and Cachar). After the fourth or fifth year of steady cropping, these rich loamy soils should be systematically manured. The *quantity* of manure per acre, which gives the best results must be ascertained by experiments, as it varies to some extent in different soils.

To make this clear to our readers we shall give a simple example. Colonel Money, in his prize essay on Tea Cultivation, states the extra yield of tea, obtainable by the application of 250 maunds of cowdung per acre, as 2½ maunds. Now to find out what *quantity* is most suitable to any particular soil, we should manure an acre with 200 maunds of dung, another with 250 maunds, a third with 300 maunds, and a fourth with 350 maunds. If we were now to find the yield of tea to be respectively 2, 2½, 3, and 3½ maunds, it is evident that we can with advantage apply the largest quantity. But—as is more likely—if we were to find the yield to be respectively only 2, 2½, 2 7/10, and 2¾, it is equally evident that an application of 250 maunds of cowdung per acre will pay best for that particular soil.

This is the treatment we would advocate for rich, loamy virgin-soils. Heavy clay soils and light sandy soils would, however, require different management. Heavy clay soils, we would stimulate, as soon as the plants are well established, say, in the fourth year. We would heavily lime them or apply ashes, and follow it up the next year with a good dose of organic manure, so as to improve the mechanical condition of the soil. Such treatment is not unlikely to result in a yield of 7 or 8 maunds of tea per acre; its object is to develop the sleeping resources of a rich clayey soil, and if both the lime or the ashes and the organic manure are properly applied, a clayey soil, thus treated, can yield abundant harvests for ten or even twenty years, without requiring any further manure. After that period, however, systematic manuring will become necessary.

Sandy soils should be manured the year before it is intended to pluck the leaf, and should be manured yearly. There is no soil, we may remind our readers, so grateful for manures, or gives such quick returns for it, as a sandy soil.

It is a grievous mistake, to defer the manuring of an estate to the time when the plants, by disease, blight, and reduced yield per acre, give evidence that the nourishment in the soil is not sufficient to keep them in health and vigour. Prevention is better than cure. And it is certainly easier and cheaper to keep tea plants in health and vigour and free from blight, than to bring them into a healthy and vigorous condition again, after they have been weakened by systematic starvation.

Blight will and does often attack healthy plants as well as diseased plants, but it never succeeds in establishing and propagating itself on the former to anything near the extent; it does on the latter; and healthy plants shake it easily off, while diseased plants succumb.

How dangerous it is for planters to wait till the very last moment, before using manure, we have ample proof by the ruin of many coffee plantations in Ceylon and Southern India.

When the coffee industry in Ceylon was being established, the advantages of manuring were almost unknown, and coffee was planted and grown for many years without any manure to speak of, yielding at the rate of 15 to 20 cwts. per acre. The crash came about 20 years ago, when borer and leaf disease ruined many a fine coffee estate; and at one time, it may be said, that the coffee industry of Ceylon was on the brink of ruin, low prices and diseased estates being the principal causes of it. However, it recovered, and it recovered by *the application of manure.* The imports of manures into Ceylon rose suddenly from £4,050 in 1860, to £20,280 in 1863, amounted in 1875 to £87,130, and in 1877 to nearly £150,000. But even with the aid of all this manure, the good old times do not come back, and a coffee planter considers himself now extremely lucky if he gets, even with a considerable expenditure on manure, 8 to 10 cwts. per acre.

The tea industry of India can read a very profitable lesson in this, and should take advantage of the experience others have so dearly bought; for, be it remembered, India has to

compete in this enterprise with China where every ounce of tea produced, has been grown with the aid of manure.

IN connection with the subjects, we have above taken into consideration, the question naturally suggests itself, which is the best and cheapest manure, suitable for tea? There are one or two facts to which we desire to draw attention, before answering that question. Potash, soda, lime, magnesia, phosphoric acid, sulphuric acid, iron, and (for the cerealia) alkaline silicates are ingredients of a fertile soil, and if present in an available form, that is, in physical combination with the soil, are used as, and constitute along with certain constituents of water and atmospheric air, the food of plants, and are as essential to them as bread and meat to men.

Now it will be known, that different plants require their mineral plant-food in different proportions. We speak, for instance, of silica-plants, of lime-plants, of potash-plants, each requiring that plant-food which distinguishes it, in prominent proportions. The requirements of the tea plant will appear from the following analysis of the ashes of mature and young tea leaves:—

	Mature Darjeeling (Schottky)	Young Assam (Voelcker)	Mature Assam (Voelcker)
Potash ...	18·25	35·336	13·013
Soda	5·80	3·521	9·432
Sodium chloride .	3·10	2·213	1·972
Magnesia ...	10·50	11·876	7·277
Lime ...	29·75	11·751	31·983
Phosphoric acid ...	13·50	16·014	14·738
Sulphuric acid .	9·20	11·018	9·129
Oxides of Iron and Manganese ..	8·00	6·985	8·767
Silica	1·90	1·118	2·654
Total ..	100·00	99·832	99·195

Potash, phosphoric acid, lime, and magnesia, constitute therefore the chief inorganic plant-food tea requires, and planters should satisfy themselves that any manure they intend to use, should contain these substances in some available form or other.

That manure, which supplies *all* the constituents of mineral plant-food, will of course be the best and most suitable for tea, and it is argued by some that an addition, in an available form, of some nitrogen would be an advantage, as it not only acts as a stimulus and powerful distributor of mineral plant-food through the soil; but, by supplementing the quantity of this element of organic plant-food which is obtained directly or indirectly from the atmospheric air, may also enable the tea plant to more successfully withstand the weakening effects of heavy pruning and plucking. Experience, however, has shown that, except for the *graminaceæ*, highly nitrogenous manures are not suited for this country, as more ammonia is brought down by rain than plants can utilise.

But irrespective of what may be advanced for or against the use of nitrogen in this country, we desire it to be distinctly understood, that an addition of nitrogen to the soil can only *affect favourably the yield, when there is a superabundance of available mineral plant-food in the soil. If there is no such superabundance, the attempt to force the vitality of the plant* by means of nitrogen can only result in injuring it.

Nitrogen in manure, has similar effects upon the plant, as spirit or wine has upon man; while the mineral substances above referred to, are the bread and meat. The use of highly nitrogenised manures for naturally poor, or exhausted soils cannot be too strongly condemned; for though they may, temporarily, force the plants into a show of vigour, the reaction, which necessarily takes place as soon as the evanescent effects of the nitrogen are over, will only be the more severe.

Professor Ville, in his work on the Employment of Scientific Agents of Fertilization, says:—

> "You may sow wheat, in soil wanting nitrogenised matter, phosphates, potash, and lime, and it will grow and bear grain, but the stalk will be very short, thin, and weak, and the vegetation precarious. Mix with the soil a substance composed of carbon, hydrogen, and oxygen, and the result will be exactly the same. And why? Because plants take all the carbon they need from the carbonic acid of the atmosphere, and the hydrogen and oxygen from water. Hence to add these three elements to the soil is useless. On the other hand, if some substance containing assimilable nitrogen be added, a salutary effect is at once produced, for plants derive nitrogen partly from the soil and partly from the air. But this effect is as nothing compared with that of manures affording certain mineral elements. Mix these, as well as the nitrogenised matter, with calcined earth, and the fertility will equal that of the richest soil. The vegetation, no longer thin and starved, acquires vigour and activity; the plant grows straight and strong, is of a rich green colour, and produces a well-formed ear, filled with large and heavy grain."

Regarding this important question to planters, as to what constitutes the value of a manure, the lecture on "Chemistry in its relation to Agriculture," by Mr. J. B. Lawes, published in our February issue, gives some valuable information. The lecture was delivered last year, before a large meeting of eminent land-owners at Haddington, and Mr. Lawes took advantage of the occasion to give the public his matured opinion upon some of the great questions which have occupied agricultural chemists for the last half century. Mr. Lawes, by his agricultural experiments at Rothamsted (of which it was said by professor Voelcker at the December meeting of the Society of Arts, that "they redounded to the glory of England, and that there was no other country in the world where such a complete set of experiments was carried on so skilfully, so assiduously, so practically, and on so large a scale") has been well-known for the last thirty-five years, and his great practical experience adds considerable weight to his opinion.

Mr. Lawes, it will be remembered by some of our readers, took a prominent part with Pusey, Gilbert, and others in opposing, thirty years ago, Liebig's theory on the "nutrition of plants and the sources of their food," and a few hasty experiments were thought to be irreconcilable with what is now universally accepted as an incontestable fact, *viz., that crops rise and fall in direct proportion to the quantity of available mineral plant food present in the soil, or supplied to it in manure, and that all organic plant-food is directly or indirectly derived from water and atmospheric air.* It is therefore of considerable importance, to find that this great opponent of Liebig's theories has, after thirty years of continuous experiments, adopted his theory almost in its entirety. The results of Mr. Lawes' experiments are convincing, and tend to support Liebig's theory on the nutrition of plants. "Was it possible," says Mr. Lawes, "that the sole manurial properties of that dark mass of strong-smelling substance they call farm-yard manure were due to the chemical salts it contained? And was it true that plants preferred their food in that form? I wish you," he continues, "to assent to this, if I prove to your satisfaction that the organic matter which constitute so large a proportion of farm-yard dung did not act as manure at all." And after giving the results of his experiments extending over thirty years, Mr. Lawes points out to the Haddington meeting, that the "evidence would be seen to be exceedingly strong in favor of the view that plants did not take up their organic matter out of the soil at all, and that consequently the organic matter in dung did not act as manure!"

Now this becomes a very important matter to the planter, when we consider that farm-yard manure, the great standard of all manures, contains in 32 tons only one ton of mineral constituents, of which fully 66 per cent. is silica and sand, and when we further consider that cattle manure must first decompose, before the plant can utilise the mineral plant-food in it, which alone, as Mr. Lawes has proved, acts as manure, if we disregard the very small quantity of nitrogen it contains, amounting only to ·297 per cent. Mr. Lawes, and no doubt with good reason, disregards this small quantity entirely, when taking into consideration the manurial value of farm-yard manure, as most of it is gone, before the manure is put into the ground.

It will not be difficult now, on the basis of these leading principles to judge of the value of any manure, the composition of which is known. A great number of manures are now offered to planters; and while we have no desire to act as partisans for any particular one, we consider it our duty to aid our readers in selecting the best and cheapest.

The great standard manures in this country, are cattle-dung and oil-cake, and a knowledge of their manurial value will be of some use, in comparing them with other manures. The manurial value and the composition of cattle-dung varies, of course, greatly with the quality of their food, but the following analysis represents a fair average composition.

INDIAN CATTLE-DUNG.

One ton contains

Water	... 13½ cwts.
* Organic matter	... 5⅝ "
Mineral matters (ash)	... ⅞ "
Total	... 20 "

* Containing *Nitrogen* ·29 per cent.

ASH.

100 parts contain

Potash	... 3·22
Soda	... 2·73
Chlorine	... 3·15
Lime	... 14·25
Magnesia	... 2·60
Phosphoric Acid	... 2·16
Sulphuric Acid	... 1·98
Carbonic Acid	... 8·20
Silica and Sand	... 58·12
Carbon and loss	... 3·59
	100·00

Only the items in italics possess any manurial value; the rest is entirely useless as manure.

Among oil-cakes we may single out *white castor cake* as most valuable, and give composition below:—

WHITE CASTOR CAKE.

100 parts contain

Moisture	... 10·19
* Organic matter	... 79·91
Mineral matters (ash)	... 7·83
Sand and Impurities	... 2·07
	100

* Containing *nitrogen* 7·78.

Only the items in italics are of manurial value.

We also give an analysis of *Cocoanut Poonac*, which is very largely used in Southern India.

COCOANUT POONAC.

100 parts contain

Moisture	... 19·04
* Organic matter	... 73·41
Alkaline Salts	... 4·81
Lime	... ·21
Magnesia	... ·65
Phosphoric Acid	... 1·15
Oxide of Iron	... ·30
Silica	... ·10
	100

* Containing *nitrogen* 2·80.

Only the items in italics are of any manurial value.

With reference to the nitrogen, contained in cattle-dung and oil-cakes, it may be necessary to say that only a portion of it can become available to the plant. The nitrogen in these manures becomes first converted into ammonia, but as such cannot diffuse through the soil and a great portion is lost. It is only in its ultimate form, as nitric acid, that it diffuses thoroughly through the soil, and that plants can get hold of it.

To facilitate the computation of the value of any manure the composition of which is known, the following table of the cost of some of the principal constituents of artificial manures has been drawn up by the Committee of the Kelso Analytical Association. The prices are "credit" rates based on the assumption that delivery will be taken at Leith, Berwick, or other sea-ports.

Vitriolated Bones and Best Dissolved Bones.—Soluble Phosphates, £20 per ton = 4s per unit; insoluble phosphates £13-15s per ton = 2s-9d per unit; ammonia, £80 per ton = 16s per unit.

Bone Ash Super-phosphates (Dissolved Bone Ash).—Soluble phosphates, £18 per ton = 3s-7d per unit; insoluble phosphates, £5 per ton = 1s per unit.

Mineral Super-phosphates.—Soluble phosphates, £16-5s per ton = 3s-3d per unit.

Bone Meals and Crushed Bones.—Phosphates, £10 per ton = 2s per unit; ammonia, £80 per ton = 16s per unit.

High Class Guanos.—Insoluble phosphates, £12-10s per ton = 2s-6d per unit; soluble and alkaline phosphates, £20 per ton = 4s per unit; ammonia, £90 per ton = 18s per unit; potash as sulphate of potash, £12-10s. per ton = 2s-6d per unit.

Mejillones and other good Guano Super-phosphates.—Soluble phosphates, £18 per ton = 3s. 7d. per unit; insoluble phosphates, £10 to £12-10 per ton = 2s to 2s-6d unit; ammonia, £80 per ton = 16s. per unit; potash as sulphate of potash, £12-10s per ton = 2s-6d per unit.

Nitrate of Soda.—Nitrogen as ammonia, £70 per ton = 14s per unit.

Potash as Sulphate.—£12 10s. per ton = 2s 6 per unit.

LABOUR IN TEA DISTRICTS.

WE fear that it is far too much the fashion among Indian planters, to look to Government to do many things, which it is altogether out of their province to do. The Tea industry, for instance, would thrive perhaps much better if Government were to exercise themselves less as to the interior economy of plantations and not regard planter and coolie alike with the tender interest with which a skilled anatomist looks upon a new subject for his knife. But it was the planter, in the first instance, who courted Government interference. Tea-planting however, we may say, has passed out of both the wet-nurse and the dry nurse stage of its existence. The coolie is no longer, if he ever was, treated with any degree of harshness, and planters have far more legitimate cause of complaint against coolies than the coolies have against planters. If Act VII (B.C.) 1873 were revised, and the many objectionable clauses struck out, it would be a great service to the public; and if the whole Act were thrown into the fire, it would be an infinitely greater one, not only to the employer, but to the true interests of the coolies themselves. We think that the sole interference of Government, should be to see that sanitation is properly carried out on the plantations, and that only healthy coolies are sent up. The operation of the ordinary laws, may be safely trusted to provide any further safe-guard that may be necessary. At present the coolie only laughs in his sleeve at the amount of unnecessary trouble he is able to give his employer, and we have no doubt that many charges are at present made, in order to give the other coolies a few days immunity from their master's supervision while he is obliged to go off to the Sudder Station to answer to a suit of trivial assault, of perhaps five rupees' amount. The best cure for this sort of thing would perhaps be to place a few Deputy Commissioners in Assam in charge of tea-gardens for a short time (not of course within their own districts), and allow them to manage, say, three or four hundred coolies, and all the money matters involved in the working of a moderate-sized plantation and the amount of trouble, annoyance, and expense to which they would be subjected would, we venture to predict, lead to a speedy reform of the Labour Acts.

If the Chief Commissioner of Assam, or some other high official appointed by Government were to travel among the the plantations of Assam and Cachar, strictly *incognito*, he would see matters as they are, and not through official spectacles. We believe that many of the high officials are most anxious to lend all legitimate support to the tea-industry, which deserves every encouragement by those who have the true interests of the Empire at heart.

An industry which is conferring enormous benefits to the common weal of this Empire, should not be burdened with an enormous expenditure for the importation of labour, seventy-five per cent. of which, it is said, is wholly unnecessary, and is due to the requirements of an Act, the absolute necessity of which is denied by the planters. If Government were only to look at the matter from a common sense point of view, the cost of importation per head into Assam, for instance, need not, on an average, exceed thirty rupees, instead of four times that amount, and Assam might in time easily become the land of the coolies' adoption, instead of a place of exile; and only occasional visits be made by the coolie to his home from whence he would bring relations and friends to share in the good things enjoyed by himself.

There is a maxim among the Nepaulese coolies in Darjeeling, that it is not the sirdars or recruiters that bring the coolies, but it is the coolies themselves that bring others and this is absolutely true. The statements of a professional recruiter are naturally listened to with suspicion, whereas the coolies themselves returning to their homes on a short visit, and bearing letters from those who remain on the plantations to their friends in the different villages, are believed especially as they bear with them not only in their pockets, but in their appearance and *tout ensemble*, substantial proofs, that their statements are true. If this system were generally extended to the recruiting districts for Assam and Cachar, there would soon be very little cause of complaint of the scarcity and dearness of labour in those localities, as very few of the poor ryots could withstand the prospects of plenty, in place of penury. We believe that this year, owing to the abundant harvest and high prices that are obtainable for grain on account of the Famine, the ryots are in many places in Lower Bengal particularly well off, but we fear that the *bunniah*, the *mahajun*, and wealthy *zemindar* will, in the shape of repayment for goods and money advanced in less prosperous times, reap the greater part of the fruits of the present prosperity, and that in a year or two the improvident ryot will be as deep as ever in the slough of despond.

In Darjeeling, the expense of importation is simply *nil*, as although money is advanced to bring coolies from Nepal, it is always received back by instalments, after the return of the recruiters with their new coolies.

We believe that the way recruiters manage to make this system pay, is by taking with them goods instead of money, and selling them in the interior of Nepal, at a very high rate of profit, and we daresay, that when the passes are open, which is oftener than the recruiter care to admit, any unexpended balance is again invested in Nepal produce, which is sold at a profit within our own territory. Looked at from a rigid point of view, this system may be open to objection, yet it is the only plan by which coolies could be brought in, free of expense to the planters, and as many coolies come in by themselves, without any advances whatever, the Darjeeling planters are to be congratulated on obtaining their labour from foreign territory at an absolutely nominal cost, while their brethren in the *labour districts* are groaning under what, unless some radical remedy is at once adopted, will soon become prohibitory rates for importing labour. Another advantage gained in Darjeeling by the present labour system is, that while the planters in the *labour districts* have to make arrangements to keep the exact number of coolies they require throughout the year, many of the Nepaulese coolies return to their homes in November and December and come back in March, with new hands just in time for the leaf-picking season, thus enabling a larger number to be employed during the manufacturing season, than could be done, if the same number of coolies had to be provided for throughout the year.

Darjeeling has thus many and great advantages in point of labour over Assam and Cachar, and there is no such thing heard of there, as work being over at 8-30 A.M.; indeed it is a singular feature in Darjeeling, that no mid-day leave is granted for meals, and the people, from their own choice, prefer feeding in the early morning, and in the evening. In Darjeeling, the *sirdars* receive one pice per diem for every man, woman, and child employed under them, so that they have a substantial interest in keeping up their muster. Planters who know their work, and know their coolies also, allow a certain number of children to be employed in proportion to the number of adults (women in Darjeeling, we consider quite as useful, during the manufacturing season at any rate, as men). By these means, a substantial inducement is offered to the adults to turn out and work; as many families by their united labour, earn as much as twenty and twenty five rupees a month, and the amount of jewellery worn by the women and girls on all grand occasions, often gold ornaments worth from fifty to one hundred rupees, testify to their general prosperity. Very often women are to be seen working on the plantations with strings of rupees hanging round their necks, but, as we have said, their appearance at the *mála* (fair), justifies the assumption that they are very comfortably off; and when many of the lower-castes are able, on grand occasions, to purchase pigs at nine and ten rupees each, work on the plantations appears to agree with the purses of the Nepaulese coolies.

We have never in a pretty extended field of observation, come across any coolies with anything like the habitual cheerfulness and willingness to work of the better class of Nepaulese coolies (we exclude the Brahmans and Chullies. The best classes of Nepaulese for work are the *goorungs* (shepherds), *rai* (cultivators or rather a caste of landholders), *newars* (traders), and nearly all the medium castes.

AGRI-HORTICULTURAL SOCIETY OF INDIA.

FLOWER SHOW ON THE 2ND MARCH 1878.

THE first Flower Show held for the last five years in Calcutta by the above Society was attended by a large and fashionable gathering. A Flower Show at this time of the year is certain to be fraught with drawbacks, and the appearance of some of the flowers were but too plainly demonstrative of the lateness of the season. Roses, although very fairly represented, lacked the bloom and perfume which they possessed six weeks ago. The orchids of course ought to have had another month to allow of their being seen in perfection. The annuals, though very pretty, were in some cases drooping and in others not arranged so as to attract attention. There was an entire absence of bouquets of cut flowers. The distance was another drawback, and with the exception of the Royal Botanical, the Eden, and Auckland Gardens, there was scarcely any competition. The foliage plants are the only ones deserving any mention at all. Of these the best specimens were sent by the Hon'ble Louis Jackson, the Royal Botanical Gardens, and the Alipore Horticultural Society's Gardens. From the Botanical Gardens, the *Adiantum Farleyense* and the *Imamtiphyllum Nuwicatum*, received from Dr. Pilcher from Natal, attracted much attention. The Hon'ble Louis Jackson exhibited two of the rarest and most ancient of foliage plants, as also the *Ghya*. The Horticultural Society's Gardens, Alipore, exhibited twenty specimens of Crotons, six of Anthuriums, twenty-four Dracenas, about twenty-five Palms, and the only specimen of the *Cuba japonica*. The plants were arranged in tents, and from 4 o'clock there was a stream of spectators passing to and fro admiring and inspecting them.

Their Excellencies the Viceroy and Lady Lytton, Mrs. Barnett, Captain A. F. Liddell, A.-D.-C., Sir John and Lady Strachey, General

Strachey, Sir Alexander Arbuthnot, and other distinguished visitors remained on the grounds for nearly a couple of hours. H. E. the Viceroy's band, under the direction of Herr Stockel, played at intervals. It was remarked that Lady Lytton as special patron of the *fête* was allowed to depart without an offer of a bouquet.

The judges met at half-past two o'clock, discussed the respective merits of the specimens exhibited, and awarded the prizes. The following were the gentlemen selected for this duty :—Col. W. M. Lees, Messrs. Waterfield and G. L. Kemp, Doctors Lynch and King, and Mr. Blechyenden, Secretary. Mr. Head, the Superintendent of the gardens, afforded the judges such suggestions as they needed. It is a pity that the Committee did not award any prizes to the Society's gardens, as the best specimens of Crotons and other plants were exhibited by them.

CAMELLIAS.

There were about a dozen of these exhibited ; all were pink, except one—a white one, exhibited by Mr. E. S. Gubboy. Even this looked very unhealthy. In fact, none of the specimens exhibited were worthy of a first prize, and so the judges thought themselves satisfied in witholding it. By reputation, Mr. Apcar's collection of Camellias are the best in the country, and it was a general matter of regret that they were not exhibited.

ROSES.

It was anticipated that in spite of the extreme lateness of the season, there would have been keen competition, but the specimens sent by a native gentleman were poor representatives of the grand names allotted to each of them on the cards above the pots. The only flowers worth looking at were those from Belvedere, and these Mr. Ashley Eden sent, not with a view of competition, but simply to fill up and add to the general effect. It is a great pity that they were not more carefully arranged.

BIGNONIAS.

These were very fair specimens. The best belonged to the Auckland Garden. The specimens shown by the Superintendent of the Horticultural Society at Alipore were all slips of grand plants cut up for setting only a month ago.

VERBENAS.

A great number of these were exhibited. One great mistake was discernible in these plants. They were planted in pans and large pots in a manner which detracted much from their effect. Another mistake was one which under stricter conditions would have disqualified them altogether, *viz.*, the appearance of disreputable specimens among real good ones.

ASTERS.

There were some attractive specimens of these, but as a rule they do not attain any perfection in Bengal, and the sun has the effect of blighting the natural shady petals of the flower.

PHLOXES.

In addition to the prize plants exhibited, Sir Andrew Clarke sent a couple of pots of handsome specimens. These flowers were also either in pots too large or too small for them, and were badly arranged. Those with fine round petals (best specimens) occupying places with inferior plants from country seed.

PORTULACAS.

There was only one stand of these flowers from the Eden and Auckland Gardens, and had each plant had a separate pot, the damaging effects of crowding them, which was painfully apparent by the stunted growth, would have been avoided, and more complete specimens obtained.

PETUNIAS.

There was only one pot of double Petunias worth notice, and to this was awarded a prize. The others were not only too numerous, but were very inferior.

CROTONS.

If ever there was an error in judgment, it was in the judges awarding the prize to Mr. Bartlett for the best collection of *recent introduction*, because in this lot there were specimens of old plants which were certainly out of place, such as the *Croton undulatum* and the *Croton Mbacina*. In addition to this, wrong names were put on ; such as *Macticum* for *Lactium*. Surely these ought to have disqualified Mr. Bartlett's lot. Properly speaking, Mr. Sutherland exhibited the best collection of new and recently introduced specimens of Crotons, and his lot ought to have been noticed.

GERANIUMS.

Very poor. There were, however, a few fine specimens of doubles of Bangalore importation in the Society's nursery. Some were just budding.

The following is a list of the prizes :—

TERNSTRŒMIACEÆ.

Best collection	Not awarded.
Second best	E. S. Gubboy, Esq.
Best specimen	Babu Premcomar Banerjee.

ROSACEÆ.

Best collection of 12 sorts (in pots)	
Second best	
Third best	
Best specimen	
Best stand of 20 named different cut Roses	The Hon'ble Ashley Eden, C.S.I.
Second best	
Best stand of 6	
Second best	

BIGNONIACEÆ.

Best collection of 6 kinds in flower	Auckland Garden.
Best ditto of foliage kinds	Ditto

VERBENACEÆ.

Best collection of 12 differing plants	Eden Gardens.
Second best	Auckland Garden.
Best specimen	Ditto

COMPOSITÆ.

Best collection of 6 differing plants	C. J. Futherland, Esq.
Second best	C. Bartlett, Esq.

VIOLACEÆ.

Best collection of 12 differing plants	Not awarded.
Second best	Eden Gardens.

POLEMONIACEÆ.

Best collection of 6 differing plants	W. Ter Veen, Esq.
Second best	Auckland Gardens.

PORTULACACEÆ.

Best collection of 6 single and 6 double differing plants	Auckland Garden.
Second best	Eden Gardens.

SOLANACEÆ.

Best collection of 6 differing plants	Eden Gardens
Second best	Not awarded.

SILENEÆ.

Best collection of 12 differing plants	C J Sutherland, Esq.
Second best	Auckland Garden.

TROPÆOLACEÆ.

Best collection of 12 plants	Not awarded.
Second best	Ditto

CACTACEÆ

Best collection of 12 sorts in or out of flower	Not awarded.
Second best	Ditto

EUPHORBIACEÆ.

Best collection of 12 sorts	C. J. Sutherland, Esq.
Second best	Not awarded
Best collection of recent introduction differing	G. Bartlett, Esq.
Second best	Eden Gardens.

LILIACEÆ.

Best collection of 12 sorts	Eden Gardens.
Second best	Not awarded.
Best collection of recent introduction differing	Ditto
Second best	Ditto

GERANIACEÆ.

Best collection in flower differing	Auckland Garden.
Second best	Not awarded.

MISCELLANEOUS.

Best collection of 12 kinds	
Second best	
Best collection of 6 sorts	
Second best	
Best collection	
Second best	
For the best collection of 20 kinds of foliaged plants (excluding Palms and Ferns)	
Second best collection	
For the best collection of plants in flower, other annuals	

PRESIDENT'S PRIZES.

Prizes to the value of Rs. 50 (placed at the Society's disposal, by the Hon'ble L. S. Jackson, C.I.E., President) were given for rare or well grown plants not included in the above list. Of these a prize of Rs. 5 was awarded to Rajah Suttanund Ghosal for a splendid specimen of the *Vanda Gigantea*, another to Mr. C. J. Sutherland for a grand specimen of the *Phalænopsis Chilbrium*, and a third for the *Lilium Longifolium*, exhibited by W. Ter Veen, Esq., of Ballygunge, and a fourth for two pretty little trees of China Oranges, exhibited by Mr. C. J. Sutherland.

EDITORIAL NOTES.

WE trust that the Bombay Government will see cause to alter their opinion, that no remittance of land-revenue would be necessary in favour of some of the Guzerat Districts, from which province we receive distressing accounts. Unseasonable and excessive rains destroyed the early crops, except here and there, and the late crops have been spoiled by blight and bad weather in the worst parts of the famine area. The cultivators, so far from being able to meet the demands of the Revenue Department, are not even in a position to buy seed for their lands which was supplied to them by the Famine Relief Committee to the extent of about Rs. 50,000 for the cultivation of about 80,000 acres of land.

WE would draw the attention of Government to two letters on the "Chronic Poverty of the Agricultural Classes" in our correspondence columns.

The harvest of the winter crops is now going on in many parts of Bengal, and the outturn is generally reported as satisfactory. The prospects of a good mango crop have been damaged in many districts by showers of rain and high wind, but, beyond the fact that the prices of rice continue very high, the district reports are generally favorable.

Locusts continue to appear in extraordinary numbers in Southern India, and have done great damage to the crops.

We understand that as the apparent result of certain representations made by Mr. Routledge, inquiries have been, and are still, proceeding on the subject of localities suitable for the establishment of manufactories for bamboo paper stock in India. Mr. Routledge has expressed his readiness when the question is further advanced to visit India personally, in order to select the localities suitable for the purpose in view, and in the meantime he has applied, through agents in India, for grants of land in the Central Provinces and British Burmah. It appears that British Burmah, with the sole drawback of somewhat costly labour, offers the greatest inducement for commencing this industry, inasmuch as the bamboo trade, so far as floating down the stems from the upper portions of the province to Moulmein and Rangoon, is already established as a current trade, apparently capable of widely extended development. Mr. Routledge is at the present time endeavouring to organise an association with the intention of establishing the manufacture of paper stock in that province.

Mr. Turner, District Cotton Inspector, Guzerat, sends the following information on the present condition of the cotton crop in Guzerat :—"For the information of the cotton merchants, I forward a statement of what I consider will be the amount of cotton crop in each collectorate this season. This is taken from my own personal observation, and from reports given my by the mookhees of different gaums. In the Surat districts the outturn will be about 7 to 8 annas ; in the Broach districts about a 10-anna crop , in the Kaira districts about 5 to 6 annas crop ; in the Ahmedabad and Veramgaum districts about 12 annas , and in Dhollera districts about 7 to 8 There is, however, a quantity of cotton of last year's crop remaining for sale in and about Dhollera"

The exports of oil-seeds from India are becoming very important At present India exports her oil-seeds—to the value of 5¼ millions sterling a year—instead of making oil of them here and using the refuse for manure and cattle-food, to say nothing about the extra cost of freight. Of course some vegetable oil is exported from India; castor oil from Bengal, and gingelly oil from Madras But European capitalists are wanted to set up oil-mills in India, to give their names as a warrant for standard qualities, and then India might hope to make oil one of the chief articles of export. Clever enterprise would soon be amply repaid. There are of course some oil-mills in the country, but very few, and in those the oil is by no means made so cheaply as to leave no room for competition. The loss sustained by the country from the exportation of oil-seeds is simply enormous. In one year four million cwt. of material for oil cake is sent beyond the seas, whilst the cattle are dying of hunger.

Dr. Bidie, Superintendent of the Government Central Museum Madras, has submitted to the Government of Madras a valuable report on some specimens of blighted cholum from Bellary which had been sent to him for examination. He finds that the heads of grain and the sample of the grain sent to him do not contain many insects, but are pervaded by a fungus which is the cause of the blight. This blight belongs to the same class of pests as those known to English farmers as "smut" or "bunt", namely, to the Ustilaginei. On shaking or rubbing one of the diseased cholum grains on a glass slide, it leaves a stain, which on miscroscopic examination is found to consist of myriads of minute spores, belonging to the fungus. A careful dissection of one of the grains of the cereal discloses among the normal tissues a number of minute filaments or threads and masses of pores free or packed in cells which constitute the fungus, in active growth. It need hardly be said that the grain is ultimately completely destroyed by the fungus, and that cholum partially affected will prove unwholesome as food. It is also unsafe to use grain partially blighted as seed, as, if it germinates, it is likely to perpetuate the disease. It is also probable, as in the case of smut, that the spores drop into the soil and are ready as soon as a new crop springs up to attack the plants. The insects found on the Bellary cholum were mostly weevils, larvæ of moths, &c., and are considered by Dr. Bidie to be only secondary agents, which come to complete the work of destruction inaugurated by the vegetable parasite.

We learn from Agra that this year's Horticultural Show was an unusually brilliant and successful one. Some very fine double geraniums were exhibited by the Taj gardener, Mr. Smith. Among vegetables, the turnips shown by the Collector received unqualified admiration and the first prize. Many native gardeners exhibited both vegetables and flowers, and were successful in various classes; but perhaps the most important result of these shows is, that European exhibitors are enabled to see the produce of their gardens once, at least, in a year. It was amusing, says a contemporary, to find a distinguished official standing, lost in admiration, before a basket of vegetables (professing to come from his garden) that had obtained a prize, and sighing at the thought that such things were not for him. The weather was all that could be desired—a pleasant contrast to that of last year, when a cyclone on a diminutive scale upset all the admirable arrangements that had been made. The attendance was very large. There was a "fair" also. Several ladies kindly superintended the stalls set apart for the sale of useful and ornamental articles of clothing, and the funds of the Society have no doubt been augmented thereby.

Recent experiments in the cultivation of the vanilla plant prove that the climate of Bengal is unsuited to its growth. On a very hot day the unripe pods drop off, and thus prove the inability of the plant to sustain its strength during the vicissitudes of our variable Bengal climate. It might be grown where the temperature is more equable, say in Hazareebagh.

A **correspondent** writes to the *Englishman* from Tirhoot :—"One of the first fruits of the late reforms in indigo-planting in Tirhoot is that it is to cease in some places altogether. A planter holds an agreement from a ryot, in which the latter agrees to cultivate a beegah of indigo at the old rate of, say, Rs 6. The planter comes forward voluntarily, and raises the rate to Rs. 12. The ryot (not being a member of the association) does not understand why this should be done, immediately suspects something below the surface, and forthwith refuses to cultivate the indigo at all. The planter appeals to the Magistrate, who says he cannot help him, and that his remedy lies in a long, tedious, and expensive civil suit. Several instances like this have occurred lately. The planter will, of course, be the winner in the long run, and the last state of the ryot be worse than the first; but in the meantime the planter loses his indigo, besides having to engage in hundreds of civil suits incurring heavy law expenses Why cannot the ryot be made to carry out his contract by the executive powers ? The Lieutenant-Governor promised to meet the planter half way in his reforms, and in this case certainly some measure might be adopted to ensure the planter fair play."

Despite the many vicissitudes it has undergone, and especially since the riots of 1859-60, the indigo industry, says the *Bengal Times*, is still a principal enterprise in the districts of Nuddea, Jessore, throughout Central Bengal, in Purnea, and westwards in all the districts of Behar north of the Ganges. In all these places indigo is not only largely cultivated, but from its mode of cultivation the most important article that engrosses the attention of the people. Since the riots of 1859 60, a marked decline followed the cultivation of the plant throughout Bengal Proper. To such an extent did the enterprise languish, as to threaten extinction in consequence of the hostility of cultivators ; and although it has shown a tendency to recover itself, the general area under cultivation is less than it was twenty years ago ; while the profits to be derived from the growth of jute, of European vegetables, and of valuable garden crops, such as betel, chillies, ginger, turmeric, &c., render the ryots averse to enter into engagements with the planters. The contraction of indigo cultivation in Bengal Proper has, however, been counterbalanced in the long run by its extensive cultivation in Behar and in the North-Western Provinces, and especially by the cultivation of indigo by Native capitalists, and the total annual outturn of the country is now hardly less, upon an average, than it was thirty years ago. The average may be said to be rather more than 100,000 maunds, valued at somewhat less than two and-a-half millions sterling. The total registered imports of indigo into Calcutta during 1876-77 aggregated 119,600 maunds, of which 104,970 maunds were consigned *viâ* the E. I. Railway, 10,200 maunds *viâ* the E. B. Railway, and the remainder by country boat. Taken province by province, the imports were—Bengal, 15,797 maunds; Behar, 64,790 maunds; N.-W. Provinces, 37,596 maunds; Oudh, 1,350 maunds; Punjab, 156 maunds, and the Central Provinces 11 maunds. Exports by sea from Calcutta totalled 94,130 maunds.

MANUFACTURE of indigo in Burdwan and Baukoora is in a declining condition, but Midnapore turned out 1,800 maunds in 1876-77, which is considered an average outturn. In Nuddea it holds a foremost place amongst industries and is carried on throughout the district—most extensively in the sub-divisions of Chooadangah and Meherpore. Although no precise figures have been obtained, showing the outturn for the whole district, there is every reason for supposing it to have been exceedingly meagre. In Chooadangah, the 29 factories, covering a cultivated area of 47,000 beegahs of land, produced 1,250 maunds, scarcely covering the outlay, in some cases the return being even less than the cost of manufacture. In Kooshtea sub-division results are said to have been disastrous; short outturn, inferior quality, and low prices having effectually checked cultivation in some factories, while in others a crop was grown merely with the object of enticing purchasers, and in the sudder sub-division the proprietors of the principal concern are giving up indigo cultivation for other ventures. In this district the fate of indigo would appear to be sealed. It is to be feared that planting on high lands, with a dependence on borrowed capital, will not much longer repay European supervision, and the co-operative system, tried a few years ago, under which plant was grown by ryots and profits shared with manufacturers, has proved unsuccessful, the former asserting that they are no gainers. Viewed in all it aspects, this industry has encountered so many vicissitudes of late years as to render its future, so far as prosperity is meant, exceedingly problematical. It is the condition to which various causes have reduced it that has given rise to predictions of which the probable realization can hardly be doubtful. Those who have watched it long and anxiously say that the natural tendency of profits in the various departments of trade, to equalize themselves and to fall to a minimum, must inevitably, in due course, drive out the unsound system of indigo-planting which can flourish while a cultivator gives his share of the product at inadequate rates, and which even then is dependent on the speculative results of a lucky year to meet the liabilities incurred in keeping up the concern in ordinary times.

A WELL-KNOWN Calcutta firm lately submitted to Government samples of Indian tobacco with which they proposed to supply the Commissariat Department. Their tobacco was sent by the Government of India to several commanding officers, and tried by men of the regiments. On the whole it was favorably reported on; but the Government of India could take no steps in the matter, as the supply of tobacco was generally arranged for regimentally.

MR. SCHOENEMANN's arrival at the Hill Tracts of Arrakan to succeed Dr. Brown in charge of the Government Tobacco Farm is regarded there as a proof that the Chief Commissioner's visit to Calcutta is having the effect of attracting more attention and interest to the progress that is being made under Captain Hughes, the present Superintendent of the Tribes. When Mr. Thompson was there on tour last month, accompanied by his Chief Engineer and Colonel Trevor, he is said to have manifested a very great interest in the condition of the Tribes, and to have personally acquainted himself with the details of several projects for the future development of the Hill Tracts. Stream communication with India and Akyab, and increased European supervision on the administration, were among the chief of these.

WE hear from Southern India that it is almost impossible to procure a sound potato, or one only moderately diseased at present on the Hills. In some parts of Ootacamund, especially in swamp soil, the tubers are unfit for food, even as soon as gathered. Four rupees a maund for diseased potatoes is the ordinary price. As for seed potatoe for planting, they are not to be procured on any terms. Scarcely half the area heretofore devoted to the cultivation of the potato was under crop last year.

THE opium revenue of 1877-78 bids fair to exceed the estimate of last spring by a considerable sum, but the deficient rainfall of last autumn has very seriously affected the Malwa crop of 1878, so much so, that the best authorities anticipate that the opium yield this year in Malwa will not exceed one-half of an average year's outturn. Of course the deficient crop will cause prices of Malwa opium to rise; already they have risen about 25 per cent. There will, therefore, be a short supply of Malwa opium to China this year—a result calculated to stimulate production and competition there. The Government of India is not at liberty to make good the deficiency of the Malwa crop this year from the reserve of Bengal opium in store, because the quantity of the Bengal drug for sale in 1878 has been already notified and cannot be increased in good faith. But in order to keep down prices as much as possible meanwhile, and to supply some part of the deficiency of the Malwa crop as soon as they can, the Government of India has declined to sell during the year 1879 60,000 chests of Bengal and Benares opium, being 6,000 chests more than the quantity notified for sale in 1878. We understand that at present there is no intention to raise permanently the annual provision of Bengal opium to this high figure, which indeed probably could not be maintained.

MISCELLANEOUS NOTES.

THE Indian Court at the Paris Exhibition will be on the right side of the vestibule at the main entrance. Immediately in front of it will be a copy of Boehm's statue of the Prince of Wales, presented to Bombay by Sir Albert Sassoon. The central object of the Court will be a case constructed of wood and glass, 200 feet long, and about 30 feet high, in the shape of two Mahomedan mosques united by an arcade. One of these mosques, or kiosks, will be occupied by Mr. V. E. Robinson, a well-known importer of Persian carpets into London, the other by the Maharajah of Cashmere, who will send an exquisite collection of native goods. A London correspondent of the *Pioneer* further states that the other principal exhibitors in this structure will be Messrs. Watson and Borton, Messrs. Farmer and Rogers, Mr. W. Gregory, and Mr. Lazenby Liberty, and other carpet merchants and dealers in Oriental objects occupying places of business in the West End of London. Messrs. Watson of Bombay will also exhibit. The Prince of Wales's collection will be arranged round the court in separate cases, together with the contributions of other exhibitors. A hand-book of the Indian court and its contents is being prepared by Dr. Budwood.

M. FAUTRAT has communicated to the Paris Academy of Sciences, the results of his thermometric observations during the past year on the influence of forests on the climate, and their general tenor, as detailed below, appears to bear out his earlier studies in 1876 and 1875. During the progress of vegetation in June, July, and August a tree in full leaf, imbibing its nourishment from the atmosphere, produces a movement which is reflected in the air by a slight decrease of temperature. During the daytime a rise of temperature can always be noticed above fir trees, owing to the solar heat retained by the vapours which surround the tops of the trees. It is to this moist and warm medium that the vigorous vegetation of resinous trees in poor soils must be ascribed. From concurrent thermometric observations made in forests and away from them, at 1·40 and at 14 metres above the ground level, M. Fautrat arrives at the following conclusions:—In consequence of the differences of temperature which are observed underneath the foliage and above the summits of trees a current of air from below upwards is established in forests, and also lateral currents around woods from the foliage towards the open space beyond. These currents cause a healthy breeze in hot weather. The ascending current carries off above the forests the vapours from the soil, puts this latter in communication with the clouds, and fills the office of a lightning-conductor; and it is to this, no doubt, that forests owe their remarkable property of keeping hailstorms at a distance.

The Acting Collector of Vizagapatam reported to the Madras Government as follows, on the rice trade of his Collectorate:—"The course of trade since my last writing has continued to consist in moderate supplies of rice to us from the neighbouring districts and from the north and east of the Bay. I think it likely to escape notice, unless attention is drawn to the fact that, urgent as the demand for rice was, we had very little to export, although stocks must have been as high, as they often are. 1872, 1873, 1874, and 1875 were fair years; 1876 was a bad year; nevertheless 8,75,000 rupees worth of food-grains were in that year exported, so that when we began by exporting over 11,00,000 rupees worth of food-grains in the first ten months of 1877, the failure of the north-east monsoon caused the gravest apprehensions. Since the 1st November we have imported more than Rs. 3,00,000 worth of rice and paddy. What the district wants is a full supply of its staple food—raggy and cumboo—at something like the normal price, say 32 seers per rupee. At present our prices are barely 16 seers per rupee, and there does not seem to me any reasonable hope that import can bring them down, as we have no communication with the granaries of Chatisgarh. I think, however, that the present price of dry grain, coupled with the fact that we exported nearly ten lakhs worth thereof last year supports the conclusion to which I have throughout adhered, that the tehsildars' estimates of crops were far too low. They considered that dry crops amounted to from six to eight annas all round, whilst I saw reason to estimate them at ten annas at the least. Of the 9,59,500 rupees worth of pulse and millet exported, 7,73,500 was raggy, 1,00,000 pulse, 75,000 cholum, and 11,000 cumboo; about Rs. 4 per cwt. is the price at which pulse, millet, and wheat are returned. Paddy is Rs. 3¼, rice Rs. 5, and gram Rs. 3½ per cwt. The export of gram and wheat are normal. The very moderate amount either of export or import before 1870 is striking as compared with the large fluctuations of succeeding years. The chilly and tobacco crops are good, and the complaints of want of water and fodder are not yet numerous. It may be that good mango showers will relieve our apprehensions in this score; the public health is fairly good."

Some experiments have been made in the Madras Presidency, with a view to determining whether the prickly-pear cannot be advantageously employed in the manufacture of paper. The Collector of the Kistna district states that the manufacture of country paper in that district ceased almost entirely many years ago. He forwards samples of paper alleged to have been manufactured from prickly-pear fibre, but he does not believe the statement. The result is certainly very different to that attained from the experiment conducted in Tanjore, and the Revenue Board doubt the truth of the assertion. An attempt to manufacture paper from prickly-pear by itself, and in combination with other materials, was made in the Conjeveram taluq of Chingleput, but proved a failure. The reasons for the want of success are not stated. In South Arcot the result of the experiment undertaken was unsatisfactory. A full report by the Tahsildar of Cuddalore on the process adopted in the trial is submitted, from which it appears that the preparation of the fibre is attended with great difficulty, entailing expense, and that the fibre of the aloe is more likely to prove suitable. The specimens have not been forwarded. Further experiment should be made with the aloe, and the result communicated in due course. The experiment made in Tanjore demonstrates the unsuitability of the prickly-pear plant for paper manufacture; the article prepared is too coarse and brittle for use; whilst the cost, exclusive of labour, is four times that of the common country paper procurable in the local bazaars. In Trichinopoly, Madura, and Tinnevelly the manufacture of paper seems to have almost entirely died out, and no experiments were conducted. The inquiries made show that the utilization of the plant in the manner suggested is not likely to prove advantageous.

COMMUNICATED AND SELECTED.

FLAX CULTURE.

A Prize Essay by S. Edwards Todd,

Of Auburn, N. Y.—(Now of New-York City.)

The subject of flax culture may be properly considered under three parts: 1st, The preparation of the soil; 2nd, The seed, the growth and culture of the plant and harvesting; 3d, The rotting and dressing for market. The first two belong particularly to the tiller of the soil; while the third is more properly a process of manufacture. Though very distinct from each other, the three processes are frequently performed by the farmer. Flax is grown sometimes for the seed only, and sometimes for both seed and lint. The seed yields a drying oil of the best quality for painters' purposes—the residue being oil cake, used for feeding stock; and the straw yields lint of two qualities, called flax and tow. Flax is the long, straight fibre, and tow consists of the short and tangled fibre, which separates in dressing the long lint. Sometimes, however, the entire fibre is prepared as tow. The lint that is separated from the long fibre, when the flax is dressed, is called in the market "fine tow"; it is manufactured into tow-cloth, or into small ropes and cords. The flax is made into linen thread and linen cloth. "Coarse tow" consists of the entire fibre of flax, the shives having been simply removed. This is pressed into bales, weighing 800 to 400 pounds each, and is sold in most of our large cities, at 2 to 6 or more cents per pound, according to the locality and the demand, for stuffing the cushions and backs of carriages, and household furniture, for making ropes, coarse cloth, etc. There is always a good demand for flax fibre, whether it is in the long-line commonly called "flax," or fine tow, or coarse tow. Consequently, a farmer can always dispose of his crop of lint with a little labor at low prices; or he can bestow much labor in preparing it for market, and receive a proportionately larger compensation. This is one of the excellences of the flax crop, and for this reason there is no other crop that may be raised in our grain-growing regions—where a three, four, or five-year's rotation of crops has been adopted—with more profit to the farmer, and more advantage to the soil. If a farmer desires to raise it for seed only and get quick returns, it can be done with a limited amount of labor; but if he desires to have work for his laborers at those seasons of the year when nothing can be done in the field, he will always find it profitable, if he is a good manger, to grow a crop, and prepare the fibre for market.

Characteristics of the plant.—Flax has one very important characteristic, an understanding of which is of great practical advantage. When a flax stem is growing alone, it will throw out numerous branches, many of which will be as large as the main stem; and each of these will produce other branches, all of which will yield seed. On the contrary, when sown thickly, each plant will produce only a straight stem, without any branches, and mature but little seed. The practical point is to decide before the seed is sowed whether the purpose be to raise flax for the seed chiefly, with coarse tow in connection, or principally for the fibre. See paragraph upon thick and thin seeding.

Soils.—Flax will flourish well on any soil that will yield good crops of cereal grain, and some soils that do not produce abundant crops of certain kinds of grain will produce an excellent crop of flax. Flax likes a deep, fertile, and mellow loam, and on such a soil a heavy crop of both seed and lint may be produced, provided there be not an excess of water in the soil. Those river bottoms and uplands, where the predominating characteristic of the soil is black muck, if fertile enough to produce heavy grass, will yield a good crop of flax fibre, and a small crop of seed. But if the soil is in a good state of fertility for yielding potatoes, oats, Indian corn, or rye, the yield of both seed and fibre will be large. Flax will not flourish on wet soils of any kind, and the crop will be light on heavy, slippery, clay soils, unless thoroughly under-drained, well pulverized, and enriched with fertilizing materials. A good crop of flax can not be produced on a poor, wet, and half-pulverized soil any more than can a good crop of wheat.

Preparing the soil.—There is no kind of grain—wheat not excepted—for which the soil needs as much preparation as is required for a good crop of flax, and there is no crop that farmers are accustomed to raise that will pay better for fertilized and pulverising the soil. Not only will the seed be better, but the fibre also, when the flax is grown on soil that is very fertile, and has been kept clean by thorough cultivation. Weeds and grass are not only a nuisance when the fibre comes to be rotted and dressed, but will seriously injure its growth; and if the dressed lint, the tow, or flax, have grass, straw, or weeds in it, the value will be greatly reduced. My own practice in getting the soil ready for a crop of flax has been to commence its preparation at least three years before, with special reference to flax. I have always raised it in rotation with Indian corn, barley, oats, winter or spring wheat, and red clover. A clover sod, well manured, is first plowed for Indian corn. If the soil is a heavy, slippery clay, or a gravelly, calcareous clay, it is plowed in the fall. If there are any wet places in the field, they at least should always be under-drained. The corn is kept clean, and no weeds allowed to go to seed. The next year a crop of barley is raised; and as soon as the barley is harvested, the soil is well harrowed with a heavy harrow, or cultivated with a wheel cultivator, for the purpose of covering the seeds of all noxious weeds, so that they may vegetate and die before winter. In October or November the soil is well plowed; and if deep, we use a double team, and a Michigan double plow. The dead furrows are cleaned out, so as to carry off the surface water. If the soil were light and porous, and not disposed to bake in the summer, we would never plow it in autumn. Where black muck predominates in the soil, or where it is a very porous, sandy, or gravelly loam, or a light alluvial deposit, it should not be plowed in late autumn, but rather in August or September. Then, if any weeds come up before winter, use the harrow, or the cultivator to destroy them. In the following spring, as soon as the ground has settled and become sufficiently dry, plow it, cutting narrow furrow slices, as deep as it has previously been plowed; and always take special pains not to have any balks or holes between the furrows. After the ground is plowed, we harrow it twice, and then roll previous to sowing the seed. The great object in harrowing and rolling before sowing the seed is to have the surface of the ground as smooth and uniform as it can be made, so that the flax may get an even start, and grow more uniformly, and the surface of the ground be better to work on when the flax is pulled. If the seed is sown on an uneven surface, where there are lumps, sods, and little furrows and holes, much of it will be buried too deep, and consequently the growth of the straw (and fibre) will not be uniform, and the seed will not mature alike. If there are no lumps, the roller should not be used, but the soil should be gone over with a harrow having numerous small teeth. Where the soil has been cultivated as it should be, while a crop of Indian corn, or barley, or potatoes was growing, the surface of it will be as free from lumps as a neatly prepared carrot bed. On such soils flax will often grow from three to four feet long; the seed will be of a superior quality, and the lint will be heavy and of great length. Where the soil is well adapted to raising potatoes and other roots, if it is well manured about two years beforehand, and the weeds thoroughly eradicated, the proprietor may be sure of a heavy crop of both lint and seed. Thoroughly rotted manure is quite as essential for flax as it is for wheat; but coarse, unfermented manure produces a rank growth of straw, not much seed, and the flax is very liable to rust. When there are many stones in the soil, the larger ones should be removed, and the smaller ones pressed down with a heavy roller before the seed is sowed, for the purpose of making a smooth surface to work upon at harvest time. In some portions of the country a black muck soil rests directly on a stratum of rich, clayey loam. Now, by using a double team and a Michigan sod plow, or any other plow turning a deep furrow well, and by turning up two or three inches depth of this fertile subsoil in late autumn or winter, so that the rains and frosts will thoroughly pulverize it before the next spring, then plowing and harrowing as just directed, a very heavy crop of lint and a fair crop of seed may be raised. But it must be kept in mind that a large crop of seed can not be raised on an inferior soil without good manure of some kind. Clean culture, a deep soil thoroughly pulverized, and in a good state of fertility, will always produce a good crop of both lint and seed, if the season is at all favourable for other crops. Flax will do as well as oats, barley, or wheat, when sowed on sod ground.

ERADICATING SMALL WEEDS BEFORE SOWING.—After the soil has been well prepared for the seed, let it remain about ten days, when nearly all the seeds of noxious weeds will have vegetated. Now, on the day that the seed is to be sowed, give it a thorough harrowing for the purpose of destroying the little weeds that have appeared in the "seed-leaf." If many lumps of earth or small stones are harrowed up, the surface must be rolled. And while the surface is fresh, let the seed be put in as speedily as possible, because flax seed, or any other seed, will germinate much sooner thus than if put into soil that has not been disturbed for a number of days.

PROPER SELECTION OF SEED.—Most farmers appear to think that flax seed is all of one quality, so far as its productiveness is concerned. There is just as much difference in the productive quality of flax seed as there is in Indian corn; and a large proportion of that which is sold in market is no more fit for seed, and no more productive, than Indian corn would be, were all the half-ripe ears shelled with the good ones for seed. No good farmer would ever think of planting such corn, because, although it might vegetate, it would not and could not produce a good yield of grain. So half-matured flax seed can not produce a good crop of either lint or seed. But unless farmers raise their own seed they will be obliged to take up with such as they are able to find in the market, whether good or poor. My own practice has been to obtain the plumpest and brightest seed to be found. Then run it through the fanning mill twice; and blow out all the light seed by a heavy blast. Then at harvest time select those stocks of flax that grow on the best ground and that ripened first, and keep them separate from the rest. Thresh off only about *half* of the seed, and save it for sowing the next season. Continue this practice for a few years, and even on the same soil, with the same cultivation, both the quality and quantity of the seed will be greatly improved, and the length and excellence of the fibre very much increased. The seed first matured—which will be the plumpest, fairest, and most productive—will be shelled out first. Every intelligent farmer will readily perceive the importance of growing his own flax seed when it can be done with so little trouble and expense.

THICK AND THIN SEEDING.—Flax may be sowed too thick as well as too thin. The correct quantity depends upon the object for which the flax is raised. If we desire to obtain the largest yield of *lint*, we must sow the seed very evenly and as thinly on the ground as it will grow and at the same time not throw out branches. If the object is simply to raise *seed* and coarse tow, it may be sowed very thin—say from half a bushel to one bushel per acre. The old rule is, half a bushel per acre, but in my experience half a bushel is not enough, because, when it stands so thin on the ground, new branches and new bolls will continue to grow, and when much of the seed is ripe, many bolls will be only half ripe. And besides this, the fibre of such large branched flax will not make as good lint as the longer less branched stalks. It may be worked into coarse tow, but it is not so good for dressed lint as the straight stalks. There is also a difference in the lint of the single stalks. If the flax seed be sowed at the rate of three or four bushels per acre, the stalks will be very small, and the fibre fine and thin, and very soft. But if only one bushel and-a-half be sowed per acre—if it be sowed as evenly as it should be—all the stems will be of a very uniform quality; the boll will grow for the most part near the very top of the stalks; and consequently the seed will ripen more evenly, and the crop will be better in every respect, than if thicker or thinner. The habit of flax is such that it will accommodate itself to the fertility of the soil better than most other plants when the quantity of seed per acre is too small. If the soil is in a very good state of fertility, and one bushel of seed be sowed evenly on an acre, almost every stem of flax will throw out only two or three branches close to the ground. When flax forms branches, we have the assurance that the seed ought to have been sowed a little thicker in those places. But when no branches are formed near the roots, it is a sign that there was as much seed sowed per acre as could grow profitably; and if the stalks appear small and slender, we need no better evidence that the seed was sowed too thickly. My own practice has been to sow about 1½ bushels of seed per acre, whether the chief object was *seed* or *lint*. I have always found that this amount of seed would give a better yield of seed and lint than any other quantity per acre.

TESTING THE SEED.—Many dealers in flax seed will contend that, as flax seed contains so much oil, it will not lose its vitality in many years. But my long experience justifies me in stating that it will sometimes lose its vitality in only a few years. Several years ago I procured a two bushel sack of Russian flax seed at a large price, and not a single seed germinated, although the soil was well prepared before it was sowed and the seed was put in when the surface was fresh and mellow and the seed possessed all the external appearance of the best. It was of a lively, brownish colour, very plump and heavy, but its vitality was gone. To test seed, select a few grains and sprinkle them between two thin pieces of sod laid earth-sides together, and put them on a shelf in the kitchen, where they must be kept warm and not allowed to dry. In a few days every seed that has not lost its vitality will germinate. Then by counting them, we readily ascertain about what proportion of them is good.

WHEN TO SOW.—Almost all writers recommend putting in the seed as early in the season as practicable. But my experience and extensive observation warrant me in saying that flax seed is almost always sowed too early. A certain season of the year that would be considered early in one locality might be very late one or two hundred miles distant in either direction. Therefore, to fix a definite period for every locality, I would say: Sow when the soil has settled and is warmed by the influence of the sun, and weeds and grass have begun to spring up, and the leaves of trees begin to unfold. If sowed too early in the season, much of it is liable to be stunted; late frosts are very apt to injure it, more or less; and noxious weeds are sure to get the start of it, unless extra pains have been taken to destroy them. The soil should not be at all adhesive or sticky when the seed is sown. The very *best time*, with reference to the condition of the soil, is, soon after a shower, when the small lumps will crumble at a very slight touch, and the entire surface is friable and "lively." Then it will germinate in a few days, get the start of weeds, and *keep* the ascendency through the season. By this means much weeding will be saved, the fibre be more abundant, the seed better, and the yield greater.

HOW TO SOW FLAX.—Every practical man knows that flax seed is very slippery grain to sow by hand. Consequently, unless a man take great care, the seed will be sowed very unevenly. As it is so very slippery, it is not practicable to sow it with a grain drill, nor with any kind of broadcast seed-sower that we have ever met with. The details of my own practice, which I have never before put on paper, are as follows: After the soil has been harrowed as directed above, mark out the ground two ways, in lands about 18 feet wide. This breadth is wide enough to sow at one round, or two *casts*. Let the seed be soaked in warm water, about two or three hours, and then rolled in plaster or gypsum. Then make calculation to sow the required quantity of seed on each land, each way. Take as much seed as you can hold conveniently with one thumb and three fingers. If you are liable to take too much seed, hold a small round stone in the hand while sowing. The object of rolling the seed in gypsum is to render it less slippery. I can always scatter the seed much more evenly by sowing a few rods wide all one way, instead of going directly back and forth. This I do by going around a land about five or six rods in width, as in plowing. The best way to mark out flax ground is to drag a long chain behind you across the field from one stake to another. It will pay well to carry out all these practical details in full. As flax seed is much more difficult to sow than most other kinds of seed, it is very important that none but an experienced sower—one able to move with a very steady and uniform gait, and to cast every handful with the accuracy of machinery—should be employed to sow flax seed. If the ground be marked out, the sower can always see where his seed falls. But when he sows by means of stakes, a deviation of only a few inches, to the right or left, will drop the seed too thin in some places, and too thick in others. The sower should always set a small stake where he commences to sow, at both ends of the plot, so that he will be sure that no strip will anywhere be sowed too thick or too thin.

HOW TO COVER THE SEED.—I never would allow a team of any kind to pass over the field, after the seed has been sowed, for the following reasons: If the soil is at all light and porous, a team will, with their feet, bury much of the seed so deeply that it will be several days behind, and never be able to attain an equal growth with the rest of the field. Another reason is, when the seed is buried so deep, the flax will pull much harder. Flax seed requires but little earth to cover it deep enough to vegetate in a short time; and by depositing it all on a smooth surface, where several seeds will not be gathered into depressions in the soil, it will all vegetate alike, will stand evenly on the ground, and pull easily, may be cut with scythes, cradles, or horse mowers, close to the ground, and the straw and lint will be of a uniform length and quality. My practice has been to "bush in" the seed by drawing a brush-harrow by hand. With a suitable brush, one man can bush in four or five acres per day, and do the work well. Such a harrow covers a strip about five feet wide, and an active man or a strong boy can cover the seed nearly as fast as he could do it with a team, and much better.

TO MAKE A HAND BRUSH-HARROW.—Procure a piece of hard-wood scantling, or a round stick, about five feet long, and three by four inches square, for the brush head; put two thills into it, and bore two sets of three quarter inch holes through it for receiving the but-ends of brush which are fastened in the holes with nails. Brush about two feet long should be selected, and after the holes are filled with them, another course may be nailed on each side of the brush-head, if necessary. This will be found a most complete implement for covering flax seed. The effectiveness of such a brush-harrow may be increased at pleasure by lashing billets of wood to the upper side of it. The length of the head may be greater or less, according to the evenness, or the unevenness, of the surface of the soil. If it should be somewhat uneven, it would be better to make two such harrows, four feet long, for two men to use, than one harrow, eight feet long, to be drawn by two men, because a short one would adapt itself to the inequalities of the surface, and cover the seed much better than a long one.

When some of the seed is buried too deeply, those plants that spring from such seed as may be covered only half an inch deep will get the start of the other by several days' growth, which will produce stalks of various lengths. This ought to be carefully guarded against in putting in the seed. Moreover, when a flax seed germinates, the kernel is carried on the end of the stem to the surface of the ground, where it forms two leaves. When seed vegetates in this manner, it is longer coming up than when only a spear is sent up, like Indian corn, wheat or oats. The difficulty is greater on heavy than on a light soil. And if flax seed be covered deep on a heavy soil, and the weather be somewhat dry, it will be impossible for it to come up, while oats or wheat would come up with no difficulty.

WEEDING FLAX.—If the soil has been prepared, and the seed put in at the time and in the manner directed in foregoing paragraphs, very little weeding will be required; but if Canada thistles, dock, wild mustard, or other noxious weeds should show their heads, let a careful man, shod with two or three pairs of old woollen socks, remove them when the flax is eight or ten inches high. A lot of boys or heedless men should never be allowed to go among flax, unless when it is very young; because if it is trodden down after it has grown a foot or more in height, most of it will never recover is erect position. The object of covering the feet with something soft is that the plants may be injured as little as possible. Hard boots and shoes will crush the stems so badly that even if they should straighten up again, there would be a bad spot in the fibre. The weeds should be *cut off* close to the surface of the ground, gathered in the arms, and carried to a pile—not thrown down. If pulled up, much of the flax will be rooted up with them. In some parts of the Old World, men, women, girls, and boys do the weeding when the flax is only a few inches high; they sit flat on the young flax, hitch along, and weed on each side of them as far as they can reach. It is better to destroy the weeds before the seed is sowed, and keep every thing off the young flax.

WHEN TO PULL (OR CUT).—As the time of ripening approaches, the observing farmer will appreciate more than at any previous period the importance of the details heretofore given. When the seed has been harrowed in and buried deep by the feet of teams, the flax will ripen very unevenly, and a portion of it will be very green, while the remainder will appear fully ripe. Under such circumstances it will be necessary to estimate what proportion of the heads are fully ripe, and how large a proportion are still too green to be pulled. When the bolls have assumed a brown color, and the leaves have died for one-fourth the length of the stems at the butt ends, and the stems themselves have changed from a dark green to a light yellowish color, then the flax is fit to pull or to cut. At this stage of growth it will yield more and better fibre than if cut at any other period. If it is too green when pulled, there will be a great loss both in *quantity* and *quality*. If the seed be put in as directed, almost all the bolls and stems will ripen uniformly; and it will be very easy to decide as to the best time for pulling or cutting without incurring any loss. When a man has a number of acres of flax to be pulled, he should not wait until it is already before he commences, lest much of it become too ripe. Should the soil be variable in its character, the flax will ripen unevenly, and the ripest portions may be pulled first. When flax is allowed to stand until it is dead ripe, the seed will be of superior quality, but the fibre will not be so heavy, strong, or soft.

PULLING FLAX.—When flax is pulled by hand, each laborer takes a strip about four feet wide, and either spreads it in a swath behind him, or throws it down in gavels, or binds it himself, as fast as he pulls it. The flax is grasped just below the bolls, with both hands, and pulled up with a sudden jerk. If it be pulled slowly, a much larger quantity of earth will adhere. As soon as one handful is pulled, it is set on the ground close to the standing flax, and held with one hand, while the other gathers as much as can be held conveniently: then both hands grasp the whole and pull. When enough has been pulled to make a gavel as large as the puller can grasp with both hands, which will make a bundle about five inches in diameter, it is "butted" once or twice on the ground to even it. Any scattering stalks standing or lying on the ground are gathered for bands, and the gavels are bound at once. This mode is usually adopted in preference to spreading in swaths. If the weather be wet and lowery, it will be better, at any rate, to bind the flax as fast as pulled, and to set the gavels in long stooks. These should always be set up north and south, so that the sun may shine on both sides of the stook in the course of the day. Before the gavel leaves the hands of the puller, he should strike it once or twice on the ground, or on his foot, to knock off the dirt. If the weather is pleasant, it is always better to spread out each gavel as it is pulled, about one inch thick, for the purpose of sunning it. After it has lain in the sun from half a day to a day, it ought to be turned over to sun both sides. An expert puller will throw every gavel down in such a manner that they may be readily gathered when cured enough to be bound up. As flax will hang together, if in a continuous swath, it is better to leave a space of two or three inches between the spread gavels, and sometimes they are laid alternately heads and buts. This is important, so that they may each be turned over readily, or taken up and bound, without tangling. When it is bound as soon as pulled, and set in stooks, it will require from one to two weeks to cure before it will be fit to stack or mow. When it is bound as fast as it is pulled, the outside of the flax will, in a very few days, all appear sufficiently cured to be stacked, while much of the middle of the bundles will be too green. It is quite important to cure all the stacks and seed bolls thoroughly before stacking, as to cure hay, or any kind of grain. The question is frequently asked, why it is not as well to cut flax as to pull it? The fibres of flax diminish in size, tapering from a few inches above the root until they run entirely out at the root of the plant. It will therefore run much smoother when spun, and will form a cleaner and smoother thread if pulled than if the fibre is cut in two. If the stalks can be cut within an inch of the root, nearly the entire length of the fibre will be secured, as well as a part of the advantage of this tapering of the fibre. In some parts of our country dealers make a difference in the price between "reaper-cut" and pulled flax.

PULLING WITH MACHINES.—Several different machines have been invented for pulling flax which have done tolerably good work when the ground was smooth, level, and so dry that but little earth adhered to the roots. Most of them injured the fibre more or less, and some could not be adjusted to pull short and long flax equally well, nor would they always deliver it evenly; and when much earth adhered to the roots, it would either obstruct the machinery, or too much hand labor is required to remove the dirt before it became dry. In some instances where the soil was prepared with much care and the seed put in as previously directed, the writer has seen flax pulled in a neat manner at the rate of three to four acres per day, with two hands and two horses. But flax-pulling machines have only been introduced to a very limited extent as yet.

CRADLING AND MOWING FLAX.—When the soil has been prepared, as previously directed, and the surface made very smooth, if the flax stands up well, an expert cradler will cut it very close to the ground, and lay it evenly in a swath. But I have always found that I could cut it closer with a scythe than with a cradle, do it with less fatigue, and at the same time lay it in a swath quite as evenly as it could be done with a cradle. The scythe must be placed flat on the ground, and both heel and point kept well down, not only when it is set in, but in pointing out. I was always accustomed to cut a swath about 7½ or 8 feet wide, and when pointing out to jerk the point of the scythe towards me, as soon as the last stalks were cut off. This motion of the scythe tended to straighten the under side of the swath, and by bringing the heel around just so far every time, and giving the scythe just a certain motion, I could always lay the flax as straight as if it had been pulled, and, if the ground was smooth, could shave it within an inch of the surface. The small amount of fibre that remained in the stubble would not be an equivalent for the greater expense incurred by pulling. When any of the flax has grown so large that it falls down, it can be cut with a scythe much better than with a cradle. If it is very long and heavy, when it is down it will be better to pull such plots than to mow [illegible] em. Let the swaths be turned over after they have been sunned sufficiently. In turning, thrust a pole under the swath, and turn only enough at a time to make one bundle, keeping the divisions distinct. Whether the flax is pulled, cradled, or mowed, it is important to keep the buts as even as practicable before binding the gavels.

ASSORTING FLAX.—When f[illegible] of various lengths is bound [illegible] a large portion of the fibre of the [illegible] stalks will be [illegible] from the long fibre in the dressing, and be wasted in tow. Furthermore, when the seed is threshed off, if [illegible] stalks be bound up with [illegible] ones, many bolls will not be th[illegible] and all their seed will be lost. For these reasons, it is imp[illegible] that the [illegible] bound [illegible] same bundle with [illegible] f pul[illegible] be ve[illegible] assorted by pulling a h[illegible] of the [illegible] of the [illegible] putt[illegible] each in separate gavels. When [illegible] cradled, [illegible] short stalks may [illegible] most par[illegible], in a swath [illegible] the [illegible] swath. Long [illegible] and sh[illegible] separate [illegible] is only necessary to keep the long [illegible] short ones in separate gavels in order to dress those of [illegible] length together.

MANNER OF STACKI[illegible]—It i[illegible] flax in a barn, and it is important to kee[illegible] straw will not be mingled with it, and w[illegible] and rat[illegible] work. The best way of stacking [illegible] to [illegible] long [illegible] placing three poles, sticks of timber, or plank, side by side, f[illegible] to three feet apart, according to the length of the haulm, and one foot above the ground; and then lay two courses of sheaves, with the tops together, and with one course above another. As flax haulm will [illegible]ng together so well, the ends of the stack may be carried up square, without any post or stakes. In order to give the sheaves a good pitch, the heads of a few of the top courses may be laid on each other. Then cover it with canvass, o[illegible] with boards. If barn room can be had, [illegible] chaff and hay seed be swept away before the flax is hauled in.

TANGLED FLAX.—When flax is mowed by hand, or with a mower, and the stalks are not kept straight, it is called tangled flax. My own practice, which coincides with that of other farmers accustomed to raise flax, has been to cut it as close to the ground as possible, and cure it, rake it, cock it, and stack is, or put in a mow, just as if it were hay. When it is mowed with scythes, let it remain about one day in the swath, and then turn it over. As soon as it appears sufficiently cured, rake it into bunches with hand or horse rakes. If the weather is favorable, let it remain in bunches about as large as a man can pitch at one forkful. When flax is managed in this way, we prefer to put [illegible] in the barn in preference to stacking it. When it is stacked, however, the top of the stack should be built sloping, instead of pointed like a roof, and covered with sound boards, or with canvass, as a stack of tangled flax will not turn rain so well as hay. When the flax is to be cut with a reaper, and it is desirable to keep the stalks straight, we put on the platform as for reaping grain fork of the flax in gavels, and let them be set on the but-ends, as soon as cut. Sometimes the flax is so long and heavy that it will not be practicable to rake or fork it off while the reaper is in motion. In such a case, as soon as enough for a gavel has been cut, stop the machine, remove it with the hand, set it on the buts, and let another hand straighten it up. A little longer time will be required if the reaper is stopped for every gavel, but the work will be done enough better to compensate [illegible] the extra care, and time will be gained in the end.

THRESHING FLAX.—When flax is bound in small sheaves, we sometimes take a bundle in both hands and strike the heads on a large stone or on a plow turned upside down to the barn floor. Sometimes the seed is threshed off with flails. If the sheaves are not too large, the best way is to whip it out on a large boulder. Strips of canvas, or blankets, should be hung up on three sides, to keep the seed from flying beyond the floor. When the seed is whipped out on a stone, all the loose seed will of necessity be separated from the haulm; but when it is threshed with flails, the sheaves require much shaking to separate the shelled seed. Moreover, flails will break the stalks more or less, which works an injury to the fibre during the rotting process. When the seed is whipped out on a stone, the stalks will not be broken, and a man can thus whip out more seed than he can thresh with a flail. Another way is to thresh with a common threshing machine. If the cylinder is what is called an "over-shot," raise the concave so that the ends of the spikes in the concave and in the cylinder will just meet, but not pass between each other. If the concave is beneath the cylinder, and can not be lowered, adjust the feeding table so that a bundle of flax may be thrust directly against the middle of the cylinder. This done, thrust the top of each bundle against the cylinder in motion, and be carful not to let it be snatched out of your hands. The bundles should not be held to the cylinder after the bolls are removed, as the spikes would lacerate the fibre. Thrust the bundle against the cylinder, and withdraw it, turning it partly over, and give it another thrust, until all the bolls are removed. We never unbind our bundles of flax to thresh them with a machine.

Tangled flax is sometimes threshed with horses by treading it out, and sometimes it is run through a threshing machine, as oats and wheat are threshed. But the concave must be raised, or lowered, from the cylinder, as the case may be, so as to make as much space as possible between them, and still thresh clean. When the concave is not adjustable, some threshers take out half or two-thirds of the spikes in the cylinder. As flax seed will thresh very easily, it is not necessary to see the concave as close to the cylinder as to thresh cereal grain, and furthermore, when it is set close to the cylinder the machine will not thresh one-half as fast. If the flax is long and damp, the machine must be fed with care, or it will wind up on the cylinder, and choke the machine, or damage the fibre.

RIPPLING.—Rippling and threshing are frequently used in America as synonymous terms. In the Old World, the bolls are usually separated by rippling, which is done as soon as practicable after the flax is pulled, and before it has been allowed to cure. The flax is pulled while a portion of the seed is yet in the dough state, and the tops are drawn through a ripper, a coarse hatchel, or comb, with long, sharp-pointed iron teeth, which tear off all the bolls and chaff, whether green or matured, and the flax is hurried away to be rotted as soon as practicable before it has been allowed to cure. The bolls, seed, and chaff are all spread out on a floor and dried, and mingled with oats or barley, and ground into meal for food. This constitutes the difference between rippling and threshing. Both green and dry bolls may be separated from the haulm by rippling, but green ones can not be threshed.

[illegible]ING OR RETTING.—After the seed has been separated, the stalks [illegible]ssed into the hands of the manufacturer, whose business it is to [illegible] into the fibre for market by rotting and dressing it. If the producer desires to perform a portion of this labor himself, he should understand what to do and how to do the work. The stalk straw or haulm of flax consists of two parts—the fibre or inner bark, and the shives or woody interior portion, and which is also frequently called shoove, shove, boon, and hurl. The fibre adheres firmly to the stalk by means of a glutinous substance, and the object of rotting the stalks is to dissolve and decompose the mucilage which holds the fibre and the woody parts so firmly together; and when properly rotted, the shives will separate from the fibre as readily as bark will peel from a young willow sprout in early summer. There are two ways of rotting flax preparatory to dressing it. One is called aerial rotting, and the other water-rotting or steeping.

Aerial or dew-rotting.—This is accomplished by spreading the flax on a smooth grass plot in long straight swaths about half an inch thick. A lad goes before the man who spreads the flax and divides the bundles into handfuls, throwing them down where the swath is to be made. The spreader either bends his body forward, or squats down with the tops of the stalks toward him, and with a quick motion spreads the handfuls as fast as they can be thrown to him. There are only two things to be observed when spreading flax, which are, to keep the buts even, and to spread it of a uniform thickness. Some spread the swaths so closely that they touch each other, but I always prefer to leave a space of a few inches between to prevent the tops of one being tangled with another. After it has lain a week or ten days, it should all be turned upside down by running a long, slim twenty-foot pole beneath the swath, near the top ends of the flax, and let a man and a boy turn over a section of about twenty feet at once. I have always found that two would perform this part of the work better than one could do it with a short pole, because every time a portion of a swath is raised, unless some one stands on the swath where the separation is to be made, it will be more or less tangled. The length of time required for rotting will depend entirely on the state of the weather. If alternate rains and sunshine prevail, two, three, or four weeks will be sufficient. The length of time that flax has been spread must never be relied on as a correct guide for determining whether or not it is rotted enough. There are certain rules which all experienced flax growers understand, which will enable a beginner to determine when it is sufficiently rotted. The most reliable rule is, the stalks, if bent with the fingers, when dry, will snap like pieces of glass, and the shives separate freely from the fibre. Beginners should watch their flax every day and apply this test, lest it be rotted too much, causing a great waste of good fibre. When rotted too much, the fibre will separate from the shives at the junction of the main stem and branches, and sometimes the fibre of the main stems will separate from the shive and portions of the stem will be seen in the form of an Indian's bow when adjusted for the arrow. It needs a little experience to determine the point at which flax is sufficiently rotted.

Steeping or water-rotting.—The true way of rotting flax is to steep it in water. In dew-rotting, if the weather be ever so favourable, a good proportion of it will be rotted too much if it be kept on the ground until all the stalks are rotted enough. But when steeped or water-rotted, there is greater uniformity in the process. If it is kept in the water just long enough, it will be all rotted alike, and be done very much better than it can possibly be by dew-rotting. Moreover, flax can be rotted much sooner by steeping than by dew-rotting, the object being simply to dissolve the mucilage that holds the fibre and woody parts together, so that they will separate readily as soon as the flax has been dried. Prepare a pond of water in the same way as a mill pond, with a waste gate to let the water off at pleasure. A suitable place can be prepared on almost every farm at a trifling expense. The bundles are held in an erect position, a few inches from the ground, so that the water may pass both beneath and above them. For this purpose a platform may be made of rails or boards, and fastened down with stones or stakes. Then set up the bundles and drive down stakes, and nail strips of boards from one to the other, over the tops of the bundles, to keep them from rising out of the water, which covers the flax a few inches. Then shut the waste gate and let the pond fill. Some time a crate is made, and launched on a mill pond, and the bundles secured in it, when it is floated into deep water and sunk sufficiently with stones placed on the crate. Soft rain water is superior to spring water for rotting. While it is in the water a partial fermentation commences, which must be arrested at the proper time, or the fibre will be damaged in proportion to the degree of fermentation beyond the proper state.

WHEN TO REMOVE FROM THE STEEP.—As the proces of fermentation will progress very slowly in cool weather, and rapidly in warm, it is impossible to state any definite period of time for keeping it in the water. If the water be of the correct temperature, the process of rotting will be completed in six or seven days. The cooler the water, the longer the flax will be in rotting. After it has been steeping about five days, it should be examined carefully every day for the purpose of ascertaining when it is rotted just enough. Pull a few stalks from different bundles in several places, break them into pieces a few inches long, and pull out the shives. If they separate very freely from the fibre, the water should be let off without delay, and the flax spread out on clean grass to dry; when dry enough, it should be bound in large bundles and housed.

HATCHELING.—After the bunches have been well scutched, they are hatcheled. The teeth of a fine hatchel are about six inches long, one eighth of an inch in diameter at the large end, and taper to a sharp point. About 10 of these are set, say ¼ inch apart, in a hard board, and the fibre is drawn through them until it is sufficiently lacerated and combed. The handfuls are then twisted a little, and packed in a clean box for market. In some markets, however, hatcheled fibre will command no larger price than the unhatcheled, because the process of hatcheling is the business of the spinner, and requires skilled labor to do it properly. An inexperienced hatcheler will waste a large percentage of good fibre. For this reason, flax growers should aim simply to remove the shives or "boon," and leave the fibre as whole and long as possible, and the spinner perform the hatcheling, unless dealers make a great difference in the prices between the hatcheled and unhatcheled fibre.

ASHES AS MANURE.

By Dr. Atwater.

In giving reasons of the high value of ashes as fertilizers, I have laid special stress on several points:

(1).—They contain *all* of the food-ingredients that the plants require from the soil except one, nitrogen. (2).—By their chemical action they render the inert nitrogen of the soil available to crops. (3)—They also help to set free potash and other mineral ingredients of plant-food that are locked up in insoluble combinations in the soil. (4.)—They improve the mechanical condition of the soil. For instance, they make heavy soils lighter, and thus provide space for air and moisture to circulate through them, and prepare food for plants, enabling the roots to make their way to the food more easily, and counteract the ill-effects of drought. (5) Thus, by virtue of what they themselves contain, and what they enable soils to furnish, they constitute practically a complete fertilizer. (6).—Hence, like stable and yard manure they are fitted for all soils and crops. They are accordingly worth more for general use than ordinary commercial fertillzers such as guano, phosphates, bone, fish, potash salts, and the like, which contain but part of the list of necessary elements of plant-food, and do far less to aid crops to economize what the soil itself contains. (7).—And finally, they are generally applied in large quantities, are exposed to scarcely any waste until they are used by the plants, and therefore their effect is as lasting as it is valuable.

Plant-food removed from soil by sundry crops.

In this connection it well help us to notice what amounts of the more important ingredients of plant-food are removed from the soil by various crops, as shown in the table below. It will of course be understood that the figures in this, as in the other tables, represent general averages:—

KINDS AND AMOUNT OF CROP.	INGREDIENTS REMOVED FROM SOIL.					
	Potash.	Lime.	Magnesia.	Phosphoric Acid.	Sulphuric Acid.	Nitrogen.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
RYE.						
Grain, 25 bushels (1,400 lbs.), Straw 3,500 lbs.	35·1	12·9	6·8	19·1	4·1	38·6
OATS.						
Grain, 30 bushels, (960 lbs.), Straw 2,000 lbs...	22·0	8·2	5·0	9·8	3·0	29·6
WHEAT.						
Grain, 20 bushels, (1,200 lbs.), Straw 3,000 lbs.	25·3	8·8	5·7	16·1	3·4	39·4
CORN.						
Grain, 50 bushels (2,800 lbs.), Stalks 6,500 lbs.	72·8	29·8	22·5	51·0	8·4	76·0
HAY.						
Mixed grasses, 1½ tons (3,000 lbs) ..	39·6	21·8	9·9	12·3	7·2	[illegible]
POTATOES.						
Tubers, 150 bushels (9,000 lbs.) ..	51·3	1·3	3·6	1·44	5·4	39·6
TOBACCO.						
Leaves, 1,206 lbs., Stalks, 1,100 lbs., dry ..	118	88	19	22·5	17	82

All of those ingredients are regarded as indispensable to the growth of plants. If any one is lacking, the whole crop suffers in proportion. By continued cropping the supply of some of them becomes reduced, and a poor yield follows. The chief use of fertillizers is to furnish the plant-food the soil fails to supply. Some times one, and some times several of these ingredients are lacking. The ones most often deficient are phosphoric acid, nitrogen, and potash, Sulphuric acid, lime, magnesia, are less frequently wanting. Every crop removes certain other ingrediants, as, iron, soda, silica, and chlorine; but these are suppled in abundance by every soil.

Plant-food supplied by ashes and other fertilizers.

To understand clearly the relative action of ashes, and some other ordinary fertilizers, let us notice their comparative costs and their actual effect in the field. Fifty bushels of *unleached* ashes, 48lbs. per bushel (2,400lbs.), at 20 cents per bushel, would cost $10 per acre. Sixty bushels of *leached* ashes, 60lbs. per bushel (3,600 lbs.), at 16 1/3 cents per bushel cost also $10 per acre. Many farmers apply them more largely. A fair dressing of No. 1 Peruvian Guano ("10 per cent. ammonia standard," brand) is 300lbs. per acre. This will cost $9, at 3 cents per lb. ($60 per ton.) A dressing of 400lbs. good "ammoniated superphosphate" at $45 per ton, or 450lbs. of pure ground bone at $40 per ton, would cost the same. A similar cost per acre would give of the German potash salts 360lbs. muriate, containing 80 per cent. chloride of potassium (50 per cent. actual potash), at $50 per ton, or 300lbs. of 80 per cent. sulphate (43 per cent. actual potash) at $66 67 per ton. Ten loads of barnyard manure, of 1,500lbs. per load, a very small dressing per acre, at $1 per load, would also be $10. Taking the above fertilizers as they run, and the above as the average cost, and omitting the other ingredients (which are of small account, except the organic matter of the barnyard manure, which is always more or less useful), we have the following table:—

KINDS OF FERTILIZER.	Amount per acre.	Cost per acre.	FURNISHING INGREDIENTS.					
			Potash.	Lime.	Magnesia.	Phosphoric Acid.	Sulphuric Acid.	Nitrogen.
	lbs.	$ cts.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Unleached Ashes ..	2,400	10·00	204	768	120	48	36	..
Leached Ashes	3,600	10·00	54	900	126	54	7	..
Peruvian Guano ..	300	9·00	11	47	6	47	4	25
Superphosphate ..	400	9 00	..	76	..	52	64	10
Bone Dust	450	9 00	..	140	..	104	..	16
Fish Scrab, half dry ..	1,000	9·00	..	80	..	65	..	55
Muriate of Potash ..	360	9·00	180	..	..	..	..	..
Sulphate of Potash ..	300	10·00	129	..	..	..	125	..
Barnyard Manure ..	15,000	10·00	92	105	27	39	24	67½

This table brings out several important points.* I wish the reader might look at the figures very carefully, and note (1) what large quantities the ashes give of all the ingredients except nitrogen—much more of each than is contained in the barnyard manure. (2) That the rest are all deficient in some of the important ingredients of plant-food—the guano and fish furnish a good deal of nitrogen, and more or less phosphoric acid; the bone and phosphate a good deal of phosphoric acid and a little nitrogen, while the potash salts have little else of value than potash. (3), The unleached ashes furnish a great deal of potash, and the leached ashes considerable; while both have very large quantities of lime, whose indirect action in changing the inert nitrogen, potash, or other plant-food of the soil into forms that the plants can use is very valuable. So much for the chemistry. Now for

The effects of ashes and other fertilizers in the field farm experiment.

I examined some experiments of Mr. Farrington, the Farm Superintendent of the Maine State College of Agriculture and Mechanic Arts at Orono, which clearly illustrate the action of several of the above fertilizers. A meadow, a moderately heavy clay was being re-seeded to timothy and clover. In the middle several plots were measured, and different fertilisers applied. Land ploughed August 15th, 1872, and throughly pulverized. Seed sown, and fertilizers evenly spread and harrowed in about a month later.

Plot I.—Stable manure.
" II.—Fish scrap.
" III.—"Top-dressing."
" IV.—Ammoniated superphosphate.
Plot V.—Lime.
" VI.—Wood ashes (unleached).
" VII.—No manure.

The fish scrap (II) was the pomace left after pressing the oil out of Menhaden. The top-dressing (III) was a mixture of artificial fertilizers, calculated to furnish nitrogen, phosphoric acid, and potash, in the proportions usually found in hay. The stable manure was applied at the rate of 6 cords per acre; and, as the cost of the application to each plot was to be the same, the amount of the other fertilizers was very large, *viz.*, at the rate, per acre, of about 1,400lbs. of superphosphate, 2,500lbs. fish scrap, and 210 bushels of ashes. No manure applied since 1872. Five crops taken off. Plot VI, ashes, has lead the rest from the start, and the fifth crop, this year, was good in quality and quantity. The timothy holds out well, with considerable clover, and but little of other grasses or weeds have appeared. Next to ashes, Plot I (stable manure) did very well two or three years, but has since fallen off very much; the clover has nearly run out, and considerable red-top come in. Plot III proved somewhat inferior to Plot I, but was superior to Plots II and IV, very probably on account of the potash it contained in the fish, and superphosphate having none. The fish scrap was rich in nitrogen, and contained also considerable phosphoric acid and lime. The first crop was good, the second poorer, and the last crop amounted to very little. The clover has disappeared, the timothy is scanty, both giving place to a sparse, inferior herbage. This is the characteristic effect of nitrogenous fertilizers—a quick, stimulating action, but their force soon spent. The scant mineral food of the fish supplied one crop, after which its strength was mainly gone. The superphosphate (Plot IV) had less nitrogen and more phosphoric acid. The yield, though not as much at first, was more lasting. Still its effect was soon gone, and both clover and timothy fell away, and red-top, daisies, and weeds feebly filled their places. The phosphate, like the fish, was a partial, one-sided fertilizer, supplying part, but not all the crop needed, and it could not, like ashes, urge into activity from their sluggish combination in the soil, the materials which in itself were lacking. Plot V (lime) was no better than Plot VII.

ONE experiment does not prove a principle. The chief value of the above is for the special place where it was made, but it is clear that for that time and place, ashes brought the best returns for the money, and horse manure the next; and I should not be surprised if Mr. Farrington finds, as many other farmers have done, that even leached ashes, at 18 to 28 cents per bushel, would be more profitable than any surperphosphate he could get at $45 per ton, or guano at $60. I know there are many soils on which guano, nitrogenous superphosphate, or bone, will bring good crops for years and years. Where the nitrogen, and phosphoric acid, and lime they supply is all that is needed, and can be got in them most cheaply, there is the place to use them. By mixing those with German potash salts, complete fertilizers may be made which, like the top-dressing in Mr. Farrington's experiment, will do good work. Sometimes such mixtures will serve as well, as the best barnyard manure or ashes. But the ashes as manure are always sure, and in the majority of cases the results would, I believe, be very much like Mr. Farrington's.

PADDY CULTIVATION ON THE BANGALORE EXPERIMENTAL FARM DURING THE YEAR 1877.

As the whole of the farm is above a tank, the growth of paddy is, of necessity, confined to dry cultivation, and dependent on the rainfall alone for a supply of water. Under these circumstances it has been considered advisable to grow only the coarse variety which I am informed is that usually sown by native cultivators under similar conditions. Whether by taking advantage of the deep cultivation ensured by the use of English ploughs it will be possible to grow more valuable varieties is a question which will be subsequently investigated, but I hasten to make public the results as far as they have gone, as I consider them of no mean value in elucidating the importance of deep cultivation to combat a dry season.

The plots on which the experiments were carried out were two in number. Their history is as follows:—

Plot No. I.—On taking over the farm in August 1875 a large area of rich low-lying land was found to present the appearance of having been formerly under wet cultivation, but was at that time overgrown with a thick matted growth of course grass, on which buffaloes and cows had been grazed for some years, and by their treading in wet weather had injured the land for cultivation. Owing to pressure of other work, this land was not touched until June 1876, when it was taken in hand, and a portion (of which plot No. I forms a part) was broken up by several ploughings with English ploughs. These ploughings were given at intervals throughout the year when requisite from the sprouting of weeds, and the result was that, by the end of the season, the whole of the weeds propagating by roots were killed, and the soil stirred to a depth of some eight inches. The dryness of the season assisted this operation very materially, especially as care was taken only to work the land when it was sufficiently dry to render the pressure from ploughs and cattle uninjurious.

During the hot months of this year occasional ploughings were given, so that no stray weeds might remain in situ, and the land was brought to fine state of tilth by the end of May.

Plot No. II.—The operation of breaking up this land was similar to that of plot No. I, but was commenced in September 1876, and only ploughed to a depth of about four inches until April 1877, when a depth of 7 to 8 inches was reached.

Plot No. III.—A third plot of land adjoining the farm and worked entirely by the native plough and sparingly manured was weighed and measured to show by comparison the difference in yield. I am not in possession of all the details of this plot, as it was in possession of a native cultivator, but it had been treated in the ordinary way in every respect, but is of a slightly inferior quality of land. The difference in the treatment of this plot and those on the farm was that it received a scanty dressing of village manure, while they had none, and that it was lying untilled during 1876, while they were roughly broken up and exposed to atmospheric action.

The following are the details of cultivation calculated to a unit of one acre:—

No. of Plot.	Cultivation.	Date of sowing.	Date of harvesting.	Seed sown in measures.	YIELD.			REMARKS.	RAINFALL.	
					Grain.		Straw in lbs		N. of Month.	Inches.
					Measures.	lbs.				
No. I	Under deep cultivation since June 1876.	May 30th...	Nov. 26th...	12	1,825	3,100	5,840	Calculated from an average plot of 1 acre.	V.	3·415
									VI.	3·005
Do.	......	....	Dec. 8th ...	..	2,700	4,320	10,700	Calculated from a plot of 1 acre in the best portion of the field.	VII.	1·125
									VIII.	3·22
No. II	Sept. 1876 ..	June 5th..	Nov. 26th...	14	1,070	1,760	3,900	Calculated from an average plot of 1 acre.	IX.	1·273
									X.	9,305
No. III	Ploughed by native plough in April 1877.	About June 5th..	Nov. 26th ..	About 30	744	1,270	2,222	Calculated from an average plot of ·09 acre.	XI.	2·77
										35·170

As so much of the work in breaking up the land was due to the weeds which accumulated before the land was made over to me, financial results would, if given, only tend to mislead. The fact, however, of growing 4,320lbs. of paddy per acre with only the natural rainfall under an improved system of deep cultivation and through aeration remains. Granted that it is but an isolated fact, obtained on first-rate land and by the heavy rains of the N.-E. monsoon falling just at the time they were most required to bring the crop to maturity, it is worth the gravest consideration. It proves how rich, in this case at least, is our soil beneath the few inches usually cultivated, and naturally suggests whether it may not be so over large areas in the Mysore Province generally. Should our soil prove so—and only extended experiments all over the country can disprove the theory—it also establishes the fact that the continuance of what has been hitherto a universal custom—shallow cultivation—will not suffice to place new riches within the reach of our agriculturists, to benefit alike themselves and the revenue.

BANGALORE, 12th December 1877. F. E. HARMAN, M.R.A.C., F.C.S.,
Supdt. of Experimental Farm.

AGRICULTURE IN THE FARUKHABAD DISTRICT.

COMPILED BY THE SETTLEMENT OFFICER OF THE DISTRICT.

(Continued from page 52)

1869.

June.

This month sees the close of the past year's agricultural operations. The commencement of the new year's—*tobacco* and *arwi* (or *ghuyan*) are the only crops remaining on the ground on the 1st of the month. The first three days disposed of most of the *tobacco*, though some was standing as late as the 14th, irrigation being carried on to the very last—*arwi* was being irrigated throughout the month.

With a view to the coming crops, ploughing went on vigorously from the 1st to the 10th, and the land was then sown with Indian-corn and jowar grown for fodder.

STATISTICS.

	acres.	days.
Ploughing	39½	99
	One acre in	2½

July.

For the first eight days of the month irrigation was being carried; *arwi*, indigo, fodder jowar, and Indian-corn being the crops watered.

On the 9th, rain fell, and no further irrigation was required.

The *kharif* ploughings began on the 5th, and the last jowar was sown on the 25th.

After the rain fell ploughing began for the *rabi*, and went on from the 10th until interrupted by heavy rain the last two days of the month.

STATISTICS.

Ploughing and sowing—	acres.	days.	1 acre in
Makka ..	45	108	2·4 days.
Jowar ..	60	120	2 ,,
Ploughing—			
For rabi ..	94	124	1·3 "

August.

The last ploughings and sowings of jowar were not over till the 15th, and the plough was run through the earlier crops (*goyna*) to loosen the soil.

The rains having wholely ceased, it became necessary to irrigate the Indian corn from the 8th to the 18th.

Nothing else of any importance took place except the *rabi* ploughings, which went on daily, and, indeed, formed the real work of the month.

STATISTICS.

Sowing—	acres.	days.	1 acre in
Jowar	16½	26	1·7 days.
Ploughing—			
Rabi	184	292	1·6 "
Irrigation to makka from well	5½	28	5 "
		men.	men.
With 2 baskets	26	349	13
		baskets.	days.
		75	1½

September.

During this month (3rd to 21st) the Indian corn was cut. The fields in which it had been standing were dug or ploughed up in preparation for the coming potato crop.

The cotton fields still required weeding. The remaining *kharif* crop received no attention.

Again, throughout the month the ploughs are hard at work, some working at the now empty Indian-corn fields, others giving additional ploughings to the land intended for the ordinary *rabi* plants.

STATISTICS.

Harvest—	acres.	men.	1 acre to
Cutting makka	26½	159	6 men.
Ploughing—		days.	
For rabi	81	122	1·5 days.

1870.

June.

This year the season is somewhat later. The irrigation of the remaining hot weather crops still goes on, nor is it over before the 9th for *melons*, the 13th for *tobacco*, the 19th for *arwi*. The tobacco is all cut by the 17th, but drying it and twisting it into ropes gives occupation to the cultivator until the 26th.

Meanwhile ploughing has commenced, and goes on steadily throughout the month.

A little fodder jowar is sown, and on the 25th and 26th, a few fields of Indian-corn, when further work was stopped by the rain which kept the whole village in-doors till the end of the month.

STATISTICS.

Irrigation—	acres.	days.	1 acre in
Tobacco ..	10	37	3·7 days
Melon ..	6	26	4·3 ,,
Harvesting—		men	men to 1 acre.
Cutting tobacco	8	57	7
Twisting ropes	9	198	22
		days.	
Ploughing	21½	55	
			Acre in 2 days.

July.

The rain fell heavily for the first six days, when the weather cleared, sowing began in earnest. Indian-corn was sown from the 7th to the 18th, and jowar, cotton, indigo and hemp sowings went on simultaneously. Soon after the plough was run through the earlier crops of indigo, jowar, and cotton, which had sprung up, to loosen the earth about the roots.

The Indian-corn fields were also weeded. Meanwhile, the ploughs had been at work from the 7th daily till the end of the month. The ploughing was partly for the *kharif*, but chiefly for fields intended to grow a *rabi* crop. The manure that had been scattered over the fields was thus worked into the soil.

STATISTICS.

	acres.	days.	1 acre in
Ploughing—			
For rabi ..	93	168	1·8 days
Sowing—			
Makka ..	34	82	2·4 ,,
Jowar ..	60	130	2·1 "
Weeding—		men	men to acre.
Makka ..	32	289	9

August.

This year the jowar sowings were over by the 3rd.

Up to the 17th, Indian corn and cotton were being weeded. From 11th to the 21st, the jowar crops were being weeded and reploughed (*goyna*).

Manure was scattered over the fields and ploughed in.

For the first 22 days of the month ploughing went on steadily.

STATISTICS.

Sowing—	acres.	days	1 acre in
Jowar	4	7	1·7 days.
Ploughing—			
For rabi	245	425	1·7 ,,
Weeding—			
Makka	87	875	10 men.
Jowar	12	162	13 ,,
Cotton	6	62	10 ,,
Reploughing—	acres	days.	1 acre in
Jowar crops (*goyna*)	37½	51	1·3 days.

September.

The chief work this month was to cut the Indian-corn and dig up the roots as a preliminary to ploughing. There was still a little fodder jowar standing which was cut on the 27th.

The fields having been cleared of the "makka" crop, some during the latter half of the month were sown with carrots. In others, from 22nd to 25th, manure was laid down, and during the remaining five days of the month ploughed into the land for the potato crop.

STATISTICS.

Harvest—	acres.	men.	1 acre to
Cutting makka	28	204	7 men.
Ploughing	30	7[illegible]	2·5 days

1871.

June.

A few acres of the *rabi* crop have still to be disposed of, some wheat being threshed as late as the 6th, some "arhar" on the 8th.

Irrigation to *tobacco*, *arwi*, and *melons* is still going on, but ceases on the 4th. The last tobacco was cut on the 8th, twisting it into ropes was over on the 13th.

Ploughing is carried on daily throughout the month. The first sowings of Indian-corn took place on the 12th, of fodder jowar on the 16th, and both crops were being sown till the end of the month, cotton also was sown throughout the month, *hemp* from the 20th, and *indigo* from the 19th. A break in the rains rendered it necessary to irrigate some of the *cotton*.

STATISTICS.

Sowing—	acres.	days.	acres in
Makka .. Jowar ..	50½	107	2 days
Ploughing ..	70	121	1·7 ,,

July.

The Indian-corn sowings having been completed the previous month, the sowing of the ordinary *kharif* crops occupied the cultivators.

Jowar was being sown till the 16th, cotton till the 7th, shakarkand from 7th to 25th, rice from 18th to 25th.

By this time the fodder jowar is ready to cut, and at odd times whenever it is required, portions were cut as late at the 21st.

Weeding is another important work at this time.

Indian-corn, cotton, and jowar, the first especially requiring much labour.

At the same time a very large area has been ploughed up for the *rabi*, and the cattle have been hard at work throughout the month.

STATISTICS.

	acres.	days.	1 acre in
Ploughing—			
For rabi ..	141	189	1·3 days.
Sowing—			
Jowar ..	12	19	1·5 ,,
Weeding—		men.	men to 1 acre.
Makka ..	22½	219	10

August.

Jowar sowing ceased on the 2nd. The Indian-corn and cotton still required a little weeding but not much. From the 20th to 31st indigo was being cut. By the 20th, the Indian corn was ripe, and was cut from that day till the end of the month, thus disposing of that crop for this year.

The chief feature is still ploughing, a large area being ploughed for the *rabi* in the course of the month.

STATISTICS.

Harvest—	acres.	men.	1 acre by
Cutting makka	17	122	7 men
Re-ploughing	acres.	days.	1 acre in
Jowar	20	36	1·8 days
Ploughing—			
For rabi	11[illegible]	194	1·7 ,,

September.

The Indian-corn having been disposed of last month the early part of the month was devoted to ploughing up the vacant fields for the potato crop and the rabi fields.

Fodder jowar is still being cut as required until the end of the month.

During the last half of the month manuring the potato fields goes on busily, and the sowing commences on the 22nd, continuing till the end; carrots are also sown from the 2[illegible]th to 22nd.

On the 22nd, the first pickings of cotton were made.

STATISTICS.

	acres.	days.	1 acre in
Ploughing	238	495	2·1 days.

1872.

June.

This season was considerably later this year; melons and tobacco were being irrigated until the 20th. Arwi and sugar-cane till the 25th, when the rains obviated necessity of any further watering. The last tobacco was standing as late as 20th, drying it and twisting it into ropes went on at leisure times until the 24th.

Ploughing for the rain crops began on the 6th, and during the last week the first rain having fallen, a good deal of land was ploughed for the *kharif*.

Fodder jowar was sown from 8th to 15th. The makka sowings all took place during the last three days.

The fodder jowar also received some irrigation.

STATISTICS.

Irrigation—	acres.	days.	1 acre in
Tobacco ..	3½	19	5½ days.
Melon ..	8½	45	5½ ,,
Sugar-cane ..	7½	46	6½ ,,
Weeding—		men.	men.
Tobacco ..	1½	10	7
Sugar-cane ..	2½	20	9
Cutting—			
Tobacco ..	3½	23	7
Ploughing ..	11	30 days	2½ day.

July.

Indian-corn, cotton, jowar, indigo, and hemp are sown. The last cotton was sown on the 14th, but the Indian-corn and jowar sowings were completed by the end of the month.

Weeding soon becomes necessary and Indian corn was weeded from the 10th to the end of the month, and cotton throughout the last half of the month.

As in previous years ploughing went on continuously throughout the month.

STATISTICS.

	acres.	days.	1 acre in
Ploughing ..	95	107	1 day.
Sowing—			
Makka ..	14	47	3½ days.
Fodder jowar ..	26½	66	2½ ,,
Jowar ..	25	48	2 ,,
Weeding—		men.	men.
Makka ..	50	786	15
Cotton ..	2½	53	21

August.

The *kharif* sowings had been completed the previous month.

For the first three days, heavy rains stopped all agricultural operations. When it cleared, Indian-corn, cotton, and jowar crops were weeded, the jowar having a plough run through it, indigo was cut on 23rd and 24th: Indian corn was ripe and began to be harvested on the 23rd. Meanwhile from the 4th till the end of the month, the rabi ploughings went on daily.

STATISTICS.

Weeding—	acres.	men.	1 acre to
Makka	13	114	9 men.
Jowar	11	111	10 ,,
Cotton	4½	41	10 ,,
Re-ploughing—		days.	days.
Jowar	10	16	1½
Ploughing—			
For rabi	71	129	1·8

September.

From the 4th to the 10th the harvesting of the Indian-corn takes place. Fodder jowar is also cut at odd times for the first 15 days. At the same time the cotton and jowar crops are weeded, the latter as usual having a plough run through them first.

Ploughing still goes on every day throughout the month, but beyond this no special preparation of the potato fields by manuring, &c., commenced this month, as was the case in preceding years.

STATISTICS.

Weeding—	acres.	men.	1 acre to
Jowar	7	57	8 men.
Cotton	4½	55	14 ,,
Cutting—			
Makka	21½	195	9
Re-ploughing—		days.	days.
Jowar	8	17	2
Ploughing—			
For rabi	174	312	1·8

1869.

October.

The first half of this month was spent in cutting the jowar crops.

The latter half in ploughing for the potato and rabi crops.

Carrots were sown in Indian-corn fields from 14th to 21st.

The potato sowings did not begin till the 28th, and but very little land was thus sown during this month. The cold weather tobacco, of which there was a little, was pruned and irrigated.

STATISTICS.

	acres.	men.	1 acre by
Harvest—			
Cutting jowar	25	87	8·3 men.
		days.	*days.*
Ploughing—			
For rabi	195	364	1·8

November.

This was a busy month, the harvesting of the jowar, the cultivation of the potato, and the rabi sowings all giving occupation to the cultivators.

The jowar was being cut throughout the month as each man obtained leisure from other work.

Potato sowings which had began late last month went on until the 21st. Meanwhile the earlier sown fields required irrigation, which began on the 12th, about a fortnight after the first sowings. After the first watering, as the plants began to shoot, the ridges were dressed for the first time on the 18th.

The rabi ploughings were not over till the 24th. Sowing commenced on the 5th and continued till the end.

Indigo seed was cut and winter tobacco thinned and irrigated

Carrots also are irrigated.

STATISTICS.

	acres.	men.	1 acre to
Potatoes—			
Sowings	12½	226	19 men.
Dressing	9½	138	14 "
		days.	*days.*
Irrigating	16	65	4
Rabi—			
Ploughings	128½	221	1·4
Sowings	74½	137	1·8

December.

The jowar harvest was not over till the 18th, when the kharif was thus finally disposed of.

In the potato fields dressing the ridges and irrigation went on all the month.

Some little manuring went on the first few days for the late potato sowings, the last of which took place on the 5th.

During the last half of the irrigation of the rabi, crops began to employ the cultivators.

STATISTICS.

	acres.	men.	1 acre to
Potatoes—			
Dressing	15	237	16 men.
		days.	*days.*
Irrigating	29	110	4

1870.

January.

Irrigation again this month is the chief occupation, being given chiefly to potatoes, but also to carrots, winter tobacco, and the rabi.

Meanwhile potato fields have to be dressed, and carrots and the rabbi fields to be weeded.

A little cotton also still remained to be plucked, and the field was then dug up.

STATISTICS.

	acres.	men.	1 acre to
Potatoes—			
Dressing	10½	262	36 men.
		days.	*days.*
Irrigating	58½	[illegible]	[illegible]
Rabi—			
Irrigating	24½	115	4

1870.

October.

Ploughing went on vigorously for the first 20 days, partly for the rabi, partly for potato crops. For the latter, manuring was busily carried on till the 21st, and as the fields were manured the potatoes were sown. The sowing chiefly took place between the 9th and 24th, but was going on to some extent throughout the month. No sooner is it sown, than irrigation commences, and as soon as the plant begins to shoot, the ridges have to be raised and dressed. Carrot-sowing is carried on from last month and lasted till the 6th.

Meanwhile the jowar crops were being cut until the 24th.

The whole of the rabi sowings also were completed during the last ten days. Altogether it was a very busy month indeed.

STATISTICS.

	acres.	men.	1 acre to
Manuring for potatoes.	24	164	7 men.
		days.	*days.*
Ploughing	252	569	2·2

November.

This year potato sowings were over by the 11th. Meanwhile, the crops sown last month had to be irrigated and have the ridges dressed. These two operations went on daily throughout the month.

Carrots are weeded and irrigated, some even being sown as late as the 18th

The last rabi sowings were over on the 6th.

Meanwhile the jowar harvest commenced on the 1st, but the greater part was cut from the 13th to 1[illegible]th. Some indigo seed was cut.

The little rice that was grown was also cut and threshed.

During the last week the first rabi waterings took place.

STATISTICS.

	acres.	men.	1 acre to
Potatoes—			
Sowing	1½	26	20 men.
Dressing	24	437	18 "
		days.	*days.*
Irrigating	39½	191	5
Rabi—			
Ploughing	10½	81	3

December.

The great feature of this month is *irrigation*—irrigation to potatoes, carrots, and the rabi crops.

Besides this, the only other work the cultivators have is to dress the ridges in the potato fields.

This employed them the first half of the month, after which the ridges were not again touched.

STATISTICS.

	acres.	men.	
Potatoes—			
Dressing	10½	231	22 men.
		days.	
Irrigating	63	257	4
Rabi—			
Irrigating	41	205	5

1871.

January.

For the first half of the month irrigation is still the main work, potatoes, carrots, and the rabi each getting their share. Two days heavy rain then stopped all work; when it cleared the potato digging began, and with it carrots were also dug up.

STATISTICS.

	acres.	days.	1 acre to
Potatoes—			
Irrigating	41	168	4 days.
Rabi—			
Irrigating	27	13[illegible]	5 "

1871.

October.

Ploughing daily throughout the month. Simultaneously the jowar is being harvested, and cotton pickings go on.

The vacant Indian-corn fields are ploughed and manured for potatoes until the 19th, and the potato sowings go on from the 1st to the 25th. Irrigation and dressing the ridges of the potato becomes necessary in a few days. Hemp is cut. Arwi dug up.

On the 14th the rabi sowings begin, but are chiefly carried out towards the end of the month.

STATISTICS.

	acres.	men.	1 acre to
Potatoes—			
Manuring	12½	161	13 men.
Sowing	14½	349	25 "
Rabi—			
		days.	*days.*
Ploughing	228	487	2·2
Sowings	69	149	2

November.

Potato sowings end on the 3rd, but ridge dressing and irrigation give daily employment all the month through. Carrots are sown and irrigated.

The last remaining "arwi" was dug up on the 2nd

Indigo seed, hemp, and rice are all disposed of during the first half of the month.

Jowar is being harvested until the 23rd, by which date all has been cut.

The rabi ploughings were completed by the 4th. Sowings went on daily until the 23rd.

On the 21st they began to irrigate the early rabi crops.

STATISTICS.

	acres.	men.	1 acre to
Potatoes—			
Dressing	28	310	11 men.
		days.	*days.*
Irrigating	43½	190	4½
Rabi—			
Ploughing	5½	16	3
Sowing	77	146	2

December.

The 1st of the month sees the last rabi sown. Some indigo seed was cut as late as the 27th, while early potatoes were dug up on the 11th, and some again on the 28th. With these few exceptions nothing goes on besides irrigation, which is carried on very busily throughout the month, potatoes, carrots, and the rabi all alike requiring water.

Potatoes also have their ridges dressed, and this went on also steadily throughout the month.

STATISTICS.

	acres.	men.	1 acre to
Potatoes—			
Dressing	3½	53	15 men,
		days.	*days.*
Irrigating	38	156	4
Rabi—			
Irrigating	49	216	4½

1872.

January.

During the first week of this month rain fell. A final water was given to some potato fields from the 10th to the 14th.

But with this exception, no irrigation took place.

The rain had removed any necessity for watering the rabi, and in this respect there was a great contrast to past years.

Potato digging began earlier than usual on the 1st of the month and went on throughout it. Carrots were also dug up.

The potato fields as they fall vacant are now ploughed up. The first sowings of the hot weather crops commence, some melons being sown on the 18th and 20th.

STATISTICS.

	acres.	days.	1 acre to
Potato—			
Irrigation	4½	18	4 days.
Ploughing	15½	40	2½ "

1872.

October.

Ploughing continuously until the 16th. Manuring for potatoes commences on the [illegible]th and goes on till the end of the month. The first potato sowings take place on the 6th, but the greater part between the 17th and 25th. On the 2[illegible]th irrigation commences.

Meanwhile, ploughing having ceased on the 16th, the rabi sowings begin on the 18th, and occupy the cultivators the end of the month.

STATISTICS.

	acres.	men.	1 acre to
Potatoes—			
Manuring	12	122	10 men.
Sowing	11	106	10 "
		days.	*days.*
Irrigation	7	28	4
Rabi—			
Ploughing	79	162	2
Sowing	60	104	1·7

November.

The last potato was sown on the 6th. Irrigation meanwhile has began and goes on throughout the month. From 9th to the 18th the ridges are dressed.

Rabi sowings went on busily during the first week when they began to slacken, and closed practically by the 16th though one field was sown as late as the 25th.

Having got over their sowings the cultivators turned to their kharif crops, and set to work on the jowar, which they began to cut on the 1[illegible]th.

STATISTICS.

	acres.	men.	1 acre to
Potatoes—			
Dressing	23½	162	7 men.
		days.	*days.*
Irrigating	27	105	4
Rabi—			
Sowing	18	49	2·7

December.

This year there was some jowar sti standing this month, though but little the last field was cut on the 17th.

A little hemp was cut on 1st and 4tl All through the month the potato ridge were being dressed.

The chief employment, however, as i the other years, was irrgation t potatoes and rabi. During the latte half of the month also opium was bein irrigated.

STATISTICS.

	acres.	men.	1 acre
Potatoes—			
Irrigating	20½	81	4 day
		men.	*men.*
Dressing	12	127	10
Rabi—		*days.*	*days.*
Irrigating	60	256	4½
Opium—			
Irrigating	5½	22	4

1873.

January.

Irrigation all through the month potatoes, rabi, and opium. Some few the earliest potato crops were dug the last few days, but the real pota harvest did not commence till Marc Ridge-dressing came to an end aft the first week.

Meanwhile the ploughs had set to wo to prepare the fields for the hot weath crops. And during the last few da tobacco and melons were both sown small quantities.

STATISTICS.

	acres.	men.	1 acre
Potato—			
Dressing	4½	92	20 mer
		days.	*days.*
Irrigating	39	173	4½
Rabi—			
Irrigating	63	287	4½
Opium—			
Irrigating	7½	31	4

1870.

February.

Irrigation still continues throughout the month.

Potatoes, carrots, rabi, winter-tobacco, baingans, all are watered. During the last half of the month potato and carrot digging commences, but not to any great extent.

When the fields have been thus cleared, they are ploughed up and sown with melons.

STATISTICS.

Irrigation—	*acres.*	*days.*	*1 acre to*
Potatoes ..	44	178	4 days.
Rabi ..	26	138	5½ "
Tobacco ..	2½	9	3½ "

March.

The potato fields were being irrigated up to the 23rd, up to which date also rabi irrigation went on.

Potato-digging continued throughout the month.

As the fields fall vacant they are ploughed up and sown with melons and tobacco.

The former are sown earlier, the first having been sown last month. Tobacco-sowing did not begin til the 21st, and its irrigation began at once. The last of the cold-weather tobacco was about this time (15th to 27th).

The rabi harvest commenced during the last week, at which time the arhar was also cut.

STATISTICS.

Irrigation—	*acres.*	*days.*	*1 acre in*
Potatoes	10½	43	4 days.
Rabi	34½	162	4½ "
Tobacco	7½	29	4 "
Harvesting—		*men.*	*1 acre to*
Digging potatoes	12	261	22 men.
Reaping rabi	13	128	10 "
Sowing tobacco	5	65	13 "
Ploughing	26	66 days.	2½ days.

April.

Tobacco, melons, and arwi sowing were completed by the 6th. Meanwhile irrigation which had begun last month was going on day by day, until the end of the month. Tobacco and melons also were weeded and cleaned

The rabi harvest was progressing busily. The arhar was mostly cut during the first week, though some was standing as late as the 2 th. Threshing went on during the last half of the month. The wheat and barley were being cut daily until the 11th, though some was not cut till the 16th. Threshing began on the 19th, and continued daily up to the 23rd, but went on at intervals till the end of the month.

STATISTICS.

Irrigation—	*acres.*	*days*	*1 acre to*
Tobacco	29½	113	3 days.
Melons	7½	43	5½ "
Harvest—		*men*	*men*
Reaping rabi	68	472	7
			bullocks.
Threshing rabi	37	312 *men.* 299	9 *men.* 3
Ditto arhar	2)	121	6

May.

Tobacco and melon irrigation carried on through the month, both the crops being also weeded.

The threshing of the rabi was not over till the 23rd.

On the 24th ploughing begins again. The first fields of fodder jowar was sown on the 25th, and irrigated two days after.

Some little tobacco was cut at the close of the month.

We thus find the rabi finally disposed, the hot weather crops beginning to be cut, and the first sowings of the rain crops taking place; the boundary line between the two agricultural years had been reached.

STATISTICS.

Irrigation—	*acres.*	*days.*	*1 acre to*
Tobacco	38	148	4 days.
Melons	24½	121	5 "
Weeding—		*men.*	
Tobacco	10	84	9 men.
Threshing—	*bullocks.*		
Rabi	47	516 *men*	11 bullocks

1871.

February.

Potato-digging had already commenced the previous month, but it was not completed until after the end of this month. Meanwhile, the potatoes were being irrigated up to the very last.

The rabi was being irrigated at the same time throughout the month.

The vacant potato fields are ploughed, and towards the end of the month the first melons and tobacco sowings take place.

STATISTICS.

Irrigation—	*acres.*		*1 acre to*
Potatoes ..	12	49 days.	4 days.
Rabi ..	24	101 "	4½ "
Potato—			
Digging ..	14	101 men	7 men.
Ploughing ..	13	24 days.	2 days.

March.

This was a very busy month. Potato-digging went on busily until the 22nd. After 12 days of irrigation, the rabi harvest commences, and continues till the end of the month.

Meanwhile, the potato fields are ploughed up, and tobacco and melons sown. The chief tobacco sowings took place about the middle of the month.

From the 12th, irrigation for the tobacco.

The sarson was cut from 11th to 19th, and the arhar from the 19th to the end of the month.

STATISTICS.

Irrigation—	*acres.*	*days.*	*1 acre in*
Rabi	7	29	4 days.
Tobacco	8	27	3½ "
Harvesting—		*men.*	
Digging potatoes	8	60	17 men.
Reaping rabi	67	340	5 "
Sarson	[illegible]	71	8 "
Arhar	54	2[illegible]5	5 "
Sowing tobacco	7	105	15 "
Ploughing	10	23 days.	2½ days.

April.

Tobacco and melons were irrigated and weeded assiduously all the month through.

The arhar and wheat had been all reaped by the end, but threshing went on every day till the month's end.

The first indigo sowings took place on the 12th.

STATISTICS.

Irrigation—	*acres*	*days.*	*1 acre to*
Tobacco	21	75	3½ "
Melons	19	86	4½ "
Weeding—		*men.*	*men.*
Tobacco	11	[illegible]7	9
Melons	11	115	10
Harvest—			*bullocks.*
Threshing rabi	82	124 *men.* 118	4 *men.* 4

May.

This year also tobacco and melons are being watered all the months. Towards the end of the month the tobacco is being cut, the melons gathered

Meanwhile the rabi crops is being threshed

The vacant rabi fields are being ploughed up for the rain crops, the first sowing of fodder jowar and arwi taking place on the 12th; this soon has to be watered.

STATISTICS.

Irrigation—	*acres.*	*days.*	*1 acre to*
Tobacco	19½	7[illegible]	3½ days.
Melons	12½	58	4 "
Weeding—		*men*	
Tobacco	5½	[illegible]	men.
Threshing—		*bullocks.*	
Rabi	39	117 *men.* 112	3 bullocks. 9 men.

1872.

February.

Potato irrigation goes on all the month, but not to any great extent, and there was no rabi irrigation at all, owing to the frequent rain.

Meanwhile, the potatoes are being dug up, the fields re-ploughed, and melons being sown all through the month.

The first "arhar" was cut on the 15th. The same day some sugar-cane was sown.

STATISTICS.

Irrigation—	*acres.*		*1 acre to*
Potatoes	3	10 days	3⅓ days
Digging—			
Potatoes	9	148 men	16 men.
Ploughing	20	48 days	2½ days.

March.

Potato irrigation was completed by the 6th, digging went on till the 14th.

Ploughing for the hot weather crops lasted until the 20th.

Tobacco and melon sowing continued throughout the month. The tobacco soon required weeding and irrigation, which began on the 6th. From 6th to 20th, sugar cane was being sown.

The rabi-reaping began on the 8th, and continued all the month, but it was not over in time to escape the hail which on the 31st destroyed 20 acres of wheat.

Threshing began on the 22nd. Arhar was cut on the 30th.

STATISTICS.

Irrigation—	*acres.*	*days.*	*1 acre in*
Potatoes	1½	6	4 days.
Rabi	3½	17	5 "
Tobacco	6½	20	3½ "
Harvest—		*men.*	
Rabi	67	463	7 men.
Sowing—			
Tobacco	6½	122	19 "
Ploughing	9½	24 days	2½ days.

April.

This year the tobacco, melon, and arwi sowings were not over until the 20th. These crops, with sugar-cane, were being irrigated during the last half of the month. The tobacco and sugar-cane also require weeding

The first eight days were fully occupied in cutting the remainder of the rabi, but there was arhar still standing on the 1 th and wheat on the 21st.

From the 8th, when the reaping had nearly been completed, threshing commenced and went on till the end of the month.

Some indigo was sown on the 5th and some again on the 25th.

STATISTICS.

Harvest—	*acres.*	*men.*	*1 acre to*
Reaping rabi	13½	170	12 men.
" arhar	11	42	4 "
	bullocks	*bullocks.*	
Threshing rabi	60	175 *men.* 201	8 3 men.

May.

Tobacco, melons, arwi, sugar-cane are being irrigated all the month.

This year the threshing of the arhar and rabi was over by the 14th, but the ploughing for the rain crops only commenced on the 28th, and but little land was ploughed.

STATISTICS.

Irrigation—	*acres.*	*days.*	
Tobacco	12	6[illegible]	5 days.
Melons	15	70	4 2/3 "
Sugar-cane	[illegible]	40	6 2/3 "
Threshing		*bullocks.*	
Rabi	15	49 *men.* 42	3 bulcks 3 men.

1873.

February.

Potatoes and opium were still irrigated all the month through, but less continuously.

A few more potato fields were dug up from the 8th to the 14th, and they began to lance the poppy-heads.

Rabi irrigation, however, went on busily every day.

The fields intended for hot weather crops were being ploughed up, and during the last few days of the month the first tobacco and melon sowings were made.

STATISTICS.

Irrigation—	*acres.*	*days.*	*1 acre in*
Potatoes	11½	48	4 days.
Rabi	44½	205	4·6 "
Opium	3	14	4·7 "
Ploughing	11½	21	1·8 "

March.

The work of irrigation was nearly over. Potatoes were only irrigated till the 10th, opium till the 11th, and rabi until the 12th.

Potato-digging continued at intervals till the last day when it was completed.

Meanwhile the rabi harvesting was going on very busily throughout the month.

Ploughing went on at leisure moments throughout the month

Tobacco and melons were sown, weeded and watered in small areas.

Arhar was cut on 19th and 26th.

STATISTICS.

Irrigation—	*acres.*	*days.*	*1 acre in*
Rabi	11	51	4·5 days.
Opium	3	14	4·7 "
Reaping—		*men.*	
Rabi	64	513	8 men.

April.

The potatoes having been disposed of, the arhar was next attacked, and its cuttings completed by the 5th.

Opium harvested till the 8th.

Rabi was still being cut and finished by the 18th

Meanwhile threshing had begun and went on all the month, but especially during the last half, when all the crops had been cut.

From 1st to 17th sugar-cane was sown. Turning to the hot weather crops, the last tobacco was sown as last on the 13th; weeding went on till the 16th; irrigation all through the month. The same account may be given of the melons, except that the last sowing was on the 8th. Lastly, the poppy plants were cut, arwi and indigo sown.

STATISTICS.

Harvest—	*acres.*	*men.*	*1 acre to*
Reaping rabi	6½	35	5 men.
" arhar	26	138	5 "
		bullocks.	
Threshing rabi	56	190 *men.* 2[illegible]9	3 *blks.* 4 *men.*
Irrigating—		*days.*	*days.*
Tobacco	12½	54	4·3
Melons	16	69	4·3
Weeding—		*men.*	*men.*
Tobacco	4	45	11

May.

The last opium was extracted on the 2nd the last rabi threshed on the 3rd, thus disposing of the rabi.

The hot weather crops now give full employment.

Tobacco and melons and sugar-cane are weeded during the first half of the month, and are irrigated during the whole of it.

The irrigation is carried on daily and continually.

Indigo is sown on the 13th and 14th

To dispose of these crops we much look forward to the next month, while sugar-cane and arwi continue to be weeded and irrigated; the tobacco and melons are ripening for the harvest. Tobacco irrigation ends on the 5th. It is cut from the 3rd to 11th, and from the 12th to 21st they are engaged in twisting it into ropes.

Melons sold standing in field are disposed of from the 1st to 9th.

STATISTICS.

Irrigation—	*acres.*	*days.*	*1 acre to*
Tobacco	31	142	[illegible]6 days.
Melons	30	127	[illegible] "
Weeding—		*men.*	
Tobacco	5	49	10 men.
Melons	5	53	11 "
Cutting—			
Tobacco	7½	64	9 "
Twisting			
Tobacco	[illegible]	[illegible]	[illegible]

IRRIGATION PLUS IMPROVED AGRICULTURE.

IN discussing the value of irrigation as a panacea against famine, it is usually one side of the question alone—that of the Engineer's—which receives attention. That such a method of inquiry is calculated to lead to grave errors is shown by the very uncertain manner in which completed works have paid, though, considering their expense, further construction should not be attempted without the fullest investigation of probable success. One of the anomalies of our rule in India is the total neglect of agriculture, pure and simple. We have had, until the last few years, not a single trained agricultural officer in the country, and now, although one or two of the *rara aves* may be found, their utterances are smothered as though they were treason; their suggestions pooh-poohed; and their work judged by men so utterly unfitted for the task that any but an Indian Government would stand aghast at their verdicts. We have expended vast, and probably shall expend still vaster, sums on irrigation schemes, but they are constructed solely as engineering works, by men professing in their particular line thorough knowledge of their business, but who cannot be expected and do not pretend to know aught of agriculture. Yet it is for agricultural improvement that these works are constructed, and we urge that it is but asking a Government to use common-sense when we assert that, besides the engineers, the scientific agriculturist should have a voice on the subject. In districts where *reh* abounds, thousands of acres have been rendered permanently unfertile by improving the irrigation and permitting the ignorant ryot to use an unlimited supply of water. And all over the country, if a question on the matter has been asked of the cultivator, it has been not, How much water is necessary to bring a crop of paddy to maturity, but, How much do you—an ignorant and wasteful ryot—require? We doubt if a single engineer in Southern India knows the exact amount *necessary*, nor is he in a position to find out. He is no farmer, and is not in communication with professional agriculturists with whose aid he might acquire the information. The ryot, keenly alive to his present interests, is aware that by using an excess of water he generally is spared the trouble of improved cultivation and application of manure by securing a sufficiency of silt in the irrigation water; consequently he is not the man from whom accurate information can be derived. It is a small matter to him, as an individual, that Government spends lakhs in the construction of works, when, did they but know the real requirements of Indian crops, thousands would suffice. He is not a man who has an active voice in the matter, nor one who can make his opinion heard except by refusing to use the water—a course which even he, ignorant as he is, often adopts as a silent protest against our canal irrigation schemes. But when we multiply him by millions, and consider the revenue drawn from agricultural sources, the error becomes a national one. We pass his individual interests aside, and think of those of the community. It then becomes the question whether the country would not be in a far advanced state to that we now find it if the ryot were only allowed a sufficiency of water for irrigation purposes and were made to conserve manure and improve his cultivation, so as to make a given quantity of State water go as far in maturing his crops as experimental cultivation has proved essential. No other State in the world supplies the cultivators of its soil with manure gratis in order that they may live. Such a course is one of the most likely methods to extinguish self-reliance and breed a habit of lazy apathy—to create, in fact, a Hindoo ryot of the very worst type, ready at the least pressure to throw himself on Government support. On the Bangalore Experimental Farm, during the past year, a crop of paddy was raised on deeply-cultivated land of a naturally high fertility of 4,000 lbs. per acre, without irrigation and with a rainfall of some 40 inches; while in verdant Tanjore, blessed with an unlimited supply of richly silted irrigation water, if two crops in a year amount to 3,000 lbs. per acre on the best land, it is deemed excellent. But in the one case we have a crop raised by an intelligent system which appreciates deep cultivation; in the other the barbaric scratching of a native plough, plus water and manure supplied by the State by the heavy up-keep of irrigation works. With such results we hold that it would be a better policy of Government to give the ryot the means of agricultural education by which the first was attained, and foster the growth of agricultural knowledge by example, and if necessary pressure, than to spend such enormous sums in the construction of works which give him the means of continuing his old customs, such as Sir Arthur Cotton advocates.

There is another subject on which Government might take a lesson from agriculturists. Our works are constructed to allow of the growth of paddy, a crop requiring more water than any other cereal. Surely in India, where every drop of water is valuable, it is worth consideration whether crops, say of wheat or Indian corn, might not be substituted with advantage for the staple paddy. They are grains of higher nutritive value for human food, are alike valuable for export, and are grown in too large quantities in other parts of the world to meet with the objection that they are unsuited for general consumption. It has been recently proposed to construct tanks capable of holding double the supply of water to tide over a period of drought, but if these crops were cultivated, such an expense would be unnecessary. And it seems to be lost sight of that, in doubling the water reservoirs, the danger of their bursting and inundating the country would be enormously increased. Surely we do not wish to add floods to our many difficulties. What is wanted for India is improved agriculture to work hand in hand with the engineer, whether he gives the agriculturist water to increase his facilities for growing crops irrespective of the immediate rainfall, or whether he supplies increased means of communication by which the excess of produce in one district may be conveyed to another. We have repeatedly brought forward the necessity for recognising the value of agriculture, the danger of its continued neglect, and the false course of working round it, as is at present the custom, instead of boldly attacking the core of the difficulty and bringing irrigation and increased communication to act in unison with its reform, instead of independently. Much would be gained by co-operation, much is lost by the present course of attacking the outworks and leaving the citadel untouched; and until we change our mode of advance against the stronghold of Indian famine, we shall fail to bring about a capitulation and lasting security. Railroads will become useless when the produce becomes so low that a surplus over that required for local consumption is unknown; and events foreshadow that this may happen at no very remote period, now that exports like wheat are assuming such enormous proportions, and an import of manure and the proper use of what little we have in the country is almost unknown. With land reduced to sterility, even irrigation will fail to produce a crop, and then our engineers will find "Othello's occupation gone," and the imperial question whether it pays to hold India will answer itself.—*Madras Times.*

AGRICULTURAL STOCK.

CATTLE DISEASES.

(*To the Editor of the Times of India.*)

SIR,—I wonder whether any of your numerous readers can find time to publish their experience in curing the various maladies to which our live-stock is subject in India, or to tell us what causes those maladies, and how to recognize them when they come. To set an example, I will narrate what I have had to do once before in my 15 years of district life, and what I am now doing in the way of curing what I believe to be "*foot and mouth*;" what I believe caused it; and what the symptoms are. I have two Aden cows with their calves in my camp, and as all four have this disease on them, I have their feet and mouths washed twice a day with warm water, and dried; then I apply with a paint-brush a solution of carbolic acid, 1 to 40 of water, to the sores, if any proud flesh appears, I caustic the spots: and if the fly gets to the feet, I put a little corrosive sublimate in water into the wounds, and the maggots soon fall out. After a few days the sores lose their red appearance and dry up, the new skin comes, and the cure is completed. While the mouth is sore the animal often refuses food; it must then be fed with gruel, containing a good dash of salt. The disease came, I believe, from my animals going to drink at a trough by a well where many of the village animals were watered, the mud near the trough was deeply imprinted with their foot-marks, and these holes, after a few hours' baking in the sun presented a succession of sharp-ridged, ready-made instruments of inoculation. I therefore advise that cattle should not be driven day after day to the same place by the same road, if this is likely to be flooded, and that the animals' feet should be cleaned after they return from watering. Of course now I have my animals watered out of a pail each animal being tied up while drinking. The disease shows itself by the skin above the hoof before, or behind, or inside within the cleft becoming puffy and slightly raised; after a short time the skin bursts, and underneath the sore appears red and inflamed with perhaps a little proud flesh. In like manner inside the mouth or lips or on the tongue, appear a few blisters, which breaking show the ulcers underneath. The animals for the most part refuse their food; when they do eat anything, much saliva and froth appear about their lips and falls to the ground in long watery threads. From time to time they turn their heads towards their feet, which they seem to regard anxiously, and tenderly lick, thus conveying the poison from the foot to the mouth, and *vice versa.*

G. COUSSMAKER.

Baramati, Poona, Feb. 22.

CATTLE AND HORSE FAIRS.

The Dera Ghazi Khan Horse Fair.—This Fair was held on the 14th, 15th, and 16th of March, at Dera Ghazi Khan for the first time. It had previously been held either at Pir Adil or at Sakhi Sarwar in connection with the local fairs which are celebrated annually at those places; but this year a plot of vacant land was selected, and the Fair was held about two miles from the town of Dera Ghazi Khan. The attendance at the Fair was larger than it had been on any previous occasion. Eleven hundred and twelve animals were shown. Of these, seven hundred and forty-four were mares, and three hundred and sixty-eight horses. In 1877 only three hundred and thirty-four horses were shown, and in 1876 the number was three hundred and eighty-eight, so that it was not expected that the number shown would have increased so very largely as compared with formers years. The prizes offered were of the value of Rs. 2,000, whilst last year their value was Rs. 2,500. It was supposed by some that the Horse Fair would be less popular this year, owing to its having been left to stand upon its own merits, and having been separated from the religious Fairs to which it was formerly an adjunct. The result has been to falsify all the forebodings of a poor attendance of horses, and the Fair of 1878 has been the best in every way that has yet been held. Mr. Meyrick, Assistant Superintendent of Horse-breeding in the Punjab, and a number of cavalry officers, were present; and it was the general opinion that it would have been difficult to find a finer set of horses than had been brought together. It was also remarked that there is no indigenous breed of horses in India that can compare with the Belooch. The Beloch horses, as a rule, are somewhat small, and would be too light to be used as remounts for British cavalry; but for native irregular cavalry they are unequalled. They are very hardy, enduring, and tractable. The Beloochees bring up their horses almost like members of their own families, and the consequence is that they are easily handled and are accustomed to stand without heel ropes, so that one or two men can look after many horses at a time. The Beloochees, as is well known, invariably dismount to fight, and for this reason they always ride mares, which can be left in the charge of one or two of a party, whilst the rest engage their enemies on foot.

The Nundidroog Cattle Fair.—The annual cattle fair was held last month as usual at Nundidroog. In years gone by the show used to be a grand one, and was attended by thousands of people. Some of the best cattle procurable in India were taken for sale. Government used to encourage the breeding of superior cattle by offering prizes to be competed for at the show. The custom has, we believe, been discontinued of late,—the more the pity, as the first step which should be taken to improve the agriculture of the country is to encourage the breeding of good draught cattle.

THE GARDEN.

NOTES ON HORTICULTURE.

By W. H. L.

Aspect.—The above expressive word is aptly adopted from *aspicio*—"I behold." Most plants must *see* the sun, or rather *feel* his vivifying influence, during some hours of the period when he is shining forth on the soil. Nearly all forest plants and parasites on trees require only a brief peep at his rays, and speedily perish if their protecting shade be removed; while a few bask in his light, and would die if screened from the heat. Again, there are many species that will grow and live and last for a considerable time, yet will not flower or bear seeds, if the solar light be too strong or too weak during their term of growth. I have before me now two large pans of *Convolvulus Mauritanius*, 12 months' old, sown and grown under exactly the same conditions. There are only 12 measured feet between the pans as they stand in my front portico. *A* has been in flower for many weeks, brilliant with a mass of lilac blossoms. *B* is just beginning to show 2 or 3 flowers: the first faces the south, a pillar intervenes, and *B* therefore is nearly opposite the east. There were two healthy *Beaumontias* in the ground last year, each one alongside of the pans *A* and *B*. The one near *A* did not thrive, and was sent away, looking very stunted and sickly; while that at *B* is doing well, and has reached the roof, about 20 feet high.

I found *ferns* only succeeded in their native localities facing the east. Here on the out-door-rockery, lined with porous pots, daily filled with water, they attained great perfection; a peep of morning and afternoon sunshine satisfied their wants. The same treatment exactly suited all the *Arum* tribes, each part being kept in a deep pan of water. *Euchanis Amazonica*, which could not be made to flower in the public gardens here, showed its lovely, fragrant Narcissus-like bloom under the same conditions.

The larger *Maurandyas*, in a pair of hanging baskets, exhibit a striking dissimilarity of luxuriance. *A* on the east front is *yards* long. *B* on the south portico only [illegible]; yet both are very healthy. Pots of every known annual, *Tropæolium* and *Nasturtium*, are *middling* in partial shade; while those in the garden centre are very fine. *T. Canariensis* is most susceptible of sunshine; the morning peep kept them healthy; they ceased flowering, and their leaves shrivelled as the hours grew longer. This is a fine weed of the *Cinchona habitat* (*vide* Markham); it should be with the *Ferns* and *Arums*. Let florists and pomologists study this subject; my paper will not contain a longer catalogue of examples.

To prolong bloom.—Many good horticulturists, but not the mass of them, keep *bouquet*-bearing flowers late in season by clipping off the mature flowers in succession, *no seed vessels being permitted*, all the while giving them liquid manure *twice or thrice weekly*; three or four crops of ornamental blooms are the general result of this treatment, on the principle of *storing the sap* instead of allowing it to be wasted on capsules and pods. With *stocks* and *wall-flowers*, *mignonette*, *sweet peas*, and such fragrant plants, I clip heavily such of the finest specimens as I intend to seed well. I give the liquid manure regularly as above, and remove all superfluous seed-vessels when they first form (*vide* Lindley's *Theory of Horticulture*).

Retardation.—This can be done to trees and shrubs, by cautiously opening out the roots and keeping them as dry as consistent with their vitality. In moist climates like the Central Provinces, roses seem to wood and leaf instead of to bloom, unless cleverly managed in this way, for which reason tubs and pots give the largest specimens. I have seen "maunds" also tried in the open border, but this is risky in some unusually hot seasons, for the roots are apt to be *baked*. I retard *Gloxinias*, *Achinienes*, *Caladiums*, and such water-loving plants, by putting each one at the end of the cold season in a small part of dry loam, and then enclosing them in a dark dry box with a cover, a little carbolic powder in a linen bag at bottom of the box before putting the "thimble pots" in their places. This is the preventive for white-ants and wood-lice, which latter have shown their destructive powers lately by entering the pot underneath and devouring some choice tubers: wood ashes at the bottom of box also succeed, and steady the pots besides.

Seed-storing.—Nearly all the leguminosa and cereal grains are attacked in damp weather by grubs and weevils; but since I adopted a new plan of preservation, I have suffered no losses. Take a little fresh carbolic powder (about a large tea-spoonful will do) when bottling your beans, peas, maize, wheat, and corn; shake this into the contents when the bottle is filled, and cork it tightly. I use bottles of clear green glass that I may look at the grain occasionally. This powder did not injure my stock after 12 months' treatment. Seeds bottled in '76-77 have grown well in '77-78—not one "weevil" to be seen; nothing but glass or tin vessels will do, as the carbolic rapidly evaporates. I always put a little paste-board box of the powder (holes bored in it at the bottom) in all my seed cases; these are tin lined with a sliding cover. I never see an insect in the whole 12 months.

Blanching.—This process not only sweetens *bitter* plants, but *whitens* them temptingly. "Endine," too nauseous to the palates of most Englishmen, becomes mild as almonds. Celery loses much of its overpowering odour. In the hotter parts of India, I find covering each plant with a sheet of thick bazaar paper, tied with soft binders of hemp, and the plant again surrounded by a bamboo basket, having a sheet of newspaper fitted over it, is the best of all modes. "Earthing up" rots the plants. "Earthen pans" still answer, the heat of the sun actually *cooks* the plants, and ferments them rapidly.

A good wild vegetable.—For more than thirty years I have looked on *gnates*, a green stuff, as a dainty: the natives are very fond of it, and are always on the look-out for the plant in its young state among the early wheat, where the best and most tender can always be found. At present it is the prevailing weed in my flower beds, introduced with cattle manure of course. Here is *my* "dainty dish":—Chop up the young leaves, and cook as "spinach," adding one green chilli, butter, black pepper, and salt, frying an onion first in the butter to give a pleasant flavour. The ryots cook as follows:—A quantity is chopped and half-boiled: water poured off; fry one clove of garlic and a chilli or two, in a pice worth of mustard oil, adding some salt: let it cook; evaporate the moisture of the boiled greens, add the fried oil, and simmer very slowly till the pot crackles. When it is ready, a pice worth or two of boiled rice, and here is a good meal at less than an anna for famine kitchens: all castes who abstain from fish, flesh, and fowl delight in this vegetarian diet, which could be improved by good oils and spices.

Butooa-ke-sag is the vernacular name. I think I can remember it in England as "*stinking goosefoot*," but nobody ever thought of eating it in *my* county; they all preferred beans and bacon, and raw onions with bread! I came lately across the following, which refers to a similar plant:—

"A little known vegetable has been brought before the notice of the public; it is called Mercury, or Good King Henry. This plant, the *Chenopodium bonus henricus* of botanists, bears tender young leaves resembling spinach, which, when cooked, are but little inferior in flavour to the finest asparagus. It is a robust-growing perennial, and when once planted in deep, rich soil, requires no further cultural attention than a dressing of well-decomposed manure during the winter."

Dried tomatoes and tomatoe paste.—I have found both these preparations uncommonly good for the hot months, and they are highly medicinal for curing a torpid liver and cleansing the blood. Use the pear-shaped and cherry kinds, drying them like figs (both Dutch and Americans know of them). For extract, take a cwt. of the *largest, ripest, and soundest* fruit: extract the pulp by baking; press through hair-sieves: inspissate slowly over charcoal fire; *beware of burning*, and only use *enamelled* pans; all others spoil the colour, injure the flavour, and *may* prove dangerous to health. When stiff like "new opium," put into little white ware jars, of sizes used by Liebig for his extract of beef: then dry them off in a cool oven; put a few drops of brandy on the surface to keep off mould.; put on air tight bungs and bladders, and keep in a dry shelf. I gave this a good trial in Lower Bengal, and kept it 12 months, if carefully prepared from *picked fruit.*

As an anti-scorbutic nothing is equal to tomato juice. The Shipping Agents and Indian Government should look to this article.

In England I was asked one shilling for each middle-sized tomato: they came from "Sunny France," or "Sunnier Italy."

I have already recommended "tomato juice" as a constituent in the new "Army" "meat cake" (for portable rations on service). To the Navy it should prove still more valuable.

Dried mushrooms.—This I learned from the French. Their grocers and oilmen always keep a stock of this great addition, during our hot months, to the *poor* bill of fare. Green peas oven-dried and carefully put up are excellent. Here is a new industry for fruitful India. All these things now described, I have brought to the notice of the gold diggers and diamond washers of Africa, where they will be in some demand, vegetable food being scarce and dear in those regions.

Desiccated vegetables.—These are very easily prepared for shooting parties and such short journey by slicing up everything, put on trays in cool ovens, or in a bright sunshine in very dry weather. Get ready some bags of strong white paper; on each write the name of contents; fill them to three parts with the slices, tying up the mouths of bags with fine twine, or you can sew them if prepared: get some shallow tin packing cases; put a layer of previously warmed sand in each, then a layer of the bags, and so on, (about three layers of vegetables *and no more*) keep them in a hot sun, or cool oven till you are ready to put them in your baggage. I gave this recipe to some sportsmen going on a trip to the remote jungles of the Brahmapootra, and they spoke highly of the "dodge." These dry esculents do well for the soups and stews of "hungry hunters"—better than *none*, but are not good enough for *Gourmands.*

FORESTRY.

EXPERIMENTS are still being made in India with chesnuts from Yunnan. Seeds were sent some time ago to the Punjab Forest Department, and to Shillong, Sikkim, and Ranikhet; but at first the results were discouraging. The chesnuts sent had been gathered before they were quite ripe, and were packed in air-tight boxes, which was a mistake. However, some more seeds have been procured; and—the needful cautions observed—may perhaps repay the Government for its trouble.

THE Kangra Valley correspondent to the *Pioneer*, referring to a blue gum tree which was struck down by lightning says:—"In this instance the primary difficulty of germinating the seed having been overcome, the tree had been growing for about eight years, and had since that time come to be the representative of some 30 or 40 scattered round about. Its height was about 45 feet, and its diameter at least 15 inches. Give it a couple of years' more growth, and its value would be certainly two rupees, whether for building purposes, or for planks for tea-chests. In round numbers, you could plant about 500 of these out in an acre, allowing almost 90 square feet to each tree; and a very little calculation will show that a small experimental plantation of such a sort would amply repay the outlay. It is high time for tea planters to begin forming forests of their own; and the reason I regret that this especial gum tree should have been struck by lightning is that it was just attaining an interesting age and a size that commanded respect and attention I have often heard that the gum tree was an excellent lightning conductor, and here is a proof in point."

THE NEPAUL TIMBER TRADE.

NEPAUL possesses great wealth of timber, and its forests are in the hands of the Government. At present a considerable quantity of sâl wood finds its way across the frontier, and is largely purchased by Government, by the Railway Companies, and by private contractors, builders, and others. To obtain this timber from Nepaul, the intervention of native contractors is employed. These native contractors make their purchases from the Nepaulese depôts, and re-sell the timber at a high profit to our Government and other purchasers. Now the forest authorities in Nepaul are acute enough to see that, if they could sell direct to the English purchasers, they could obtain a higher price than they now receive, and yet supply us with timber much more cheaply than we can get it from the contractors. It has occurred to them that to abolish the contractors, and trade directly with English purchasers, might be made equally advantageous to both parties. It would be necessary that English purchasers, agents of Government, of Railway Companies, or private parties, should have access to the timber depôts, and this they are willing to permit, and indeed eager to bring about. Now here seems a rare opportunity of getting in the thin end of the wedge gently and peaceably. Access to certain timber depôts, probably not far within the frontier, would not mean a sudden or extensive opening of the country to us; but it might prove the beginning of an intercourse and a traffic which would gradually expand and spread over the country till the whole of Nepaul, with its valuable mineral as well as vegetable wealth, was laid open to the English trader. And why should Government turn a cold shoulder on such a proposal, and go on purchasing its timber at needlessly high prices from the contractors, at the same time neglecting what seems a rare opportunity of beginning to sap the barriers that now keep us out of Nepaul? Not because it desires to perpetuate those barriers; not because it desires to waste the public money; not because it is unwilling that Railway Companies and others should be able to buy cheaper timber; not because it is solicitous for the interests of the native contractors; and surely not because there is any identity between the interests of those contractors and the interests of individuals who have influence with Government? It is more charitable to suppose that the Nepaulese authorities attach to their proposals certain conditions of which we have not heard, and to which our Government cannot rightly concede. The misfortune is that in India negotiations of this kind are carried on in the dark, and as a rule the public never even hears of them. We are sorry we cannot illumine the darkness a little further in this instance. It would be interesting to know a little more fully and accurately what is the exact nature of the proposals that are being made by the Nepaulese authorities with regard to this timber trade, and also what are the reasons which make our Government hesitate to entertain them.

MINERALOGY.

WE learn that the Engineer of the Gondul State, Mr. Gunnesh Govind, has discovered a quarry of fine marble, said to be equal to the best Italian. A slab is to be sent to Bombay to ascertain its probable market value, and should inducement offer, the machinery for working the quarry will be obtained from Europe. This is the second marble quarry discovered in Kattyawar, the first being in H. H. the Jam's territories.

M. HUBEL, a mining engineer, employed by the Persian Government, is said to have found, near Zingan, a rich vein of galena, containing in some places three per cent., and everywhere more than 1¾ per cent. of pure silver. Rumour adds that, at a comparatively small outlay, the mines might be made to yield enormous revenue. Not long ago there was a talk about good mines in Persia; and they said that the Shah, in consideration of expected profits, meant to reduce all taxes by one-half. The locality of this lead mine is near the ruins called Takht-i-Sulaiman and Takht-i-Balkis, on the borders of Azarbaijan, about sixty miles west of the town of Zingan, which lies half way between Teheran and Tabriz. The mine, which consists of a vein of sulphate of lead 3½ feet thick, containing 2 to 3 per cent. of silver, was discovered by Herr Hubel in the prosecution of a search for the gold mine reported to have been found by a villager last year. Coal as well as copper and iron is plentiful in the vicinity. The Shah has granted a concession to work the mines to the Mukhber-ud-Doulah, his Director-General of Telegraphs, on the condition of paying one ton of silver into the royal treasury for every hundred tons of ore smelted. This, it is estimated, will increase the Shah's revenue by a million sterling in the first three years—a welcome addition, seeing that his whole income is rather under than over three millions.

IRON ORE IN THE KUMAON HILLS.

THE following letter appeared in a late issue of the *Englishman* contributed by BLAST FURNACE:—"During a trip through the Kumaon Hills, I was induced to visit the iron mines at Ramgarh, as well as the smelting works at Dehchouri. At the former place I saw a large quantity of ore freshly excavated, called Gwalakoori ore.

I made a rough analysis of this, as well as of the other ores in the neighbourhood, and find that the Gwalskoori ore is the poorest of all the ores to be had at Ramgarh. The metallic iron it contains is not more than 28 per cent., while there are ores in the neighbourhood which would yield 60 per cent., and they could be had at the same price as that which is being excavated.

The carriage of ore from Ramgarh to Dehchouri costs eight annas the pucca maund, so that the P. W. D. is paying fifty per cent. more for carriage of ore than there is any necessity for. Who is to blame for this? After I left Ramgarh, I visited the smelting works at Dehchouri. On inquiry I find that building, pulling down, and rebuilding is the order of the day, and has been so since the commencement of 1876. Since that time it appears that over 1,30,000 rupees have been spent in building and altering and collecting material, and that no iron has yet been made in any quantity. I pushed my inquiries still further, and I find that Government has leased these works for three years from the Kumaon Iron Company, under the understanding that the works are to be bought at the expiration of the lease for five lakhs of rupees, plus the value of the plant. I also find that the shareholders are for the most part Government officials, and that the Kumaon Iron Company never succeeded in making the place pay. If the P. W. D. after two years' trying has been unable to make iron, why should the country in these hard times pay five lakhs of rupees for that, which is of no value? I do not say that iron could not be made at Dehchouri at paying rates, but that it will pay while in the hands of the D. P. W., if one is to judge from what has been done, or rather from what has not been done during the last two years, is improbable in the extreme.

Such being the case, why should the country recoup to the shareholders of the Kumaon Iron Company the losses they have sustained in a commercial enterprise?"

A FLOWING WELL OF EARTH-OIL IN ARAKAN.

From—The COMMISSIONER of the Arakan Division,
To—The SECRETARY to the Chief Commissioner, British Burmah,
No. 106-165, dated the 6th March 1878.

I HAVE great pleasure in reporting, for the information of the Chief Commissioner, that Mr. Savage, who had received the permission of Government to prospect for oil on the Eastern Borongos, has been fortunate enough, not only to strike oil, but to come upon a real flowing well, similar, it is believed, in all respects to the descriptions we hear of some of the famous wells of the great American continent.

2. A report of the discovery was made to me on Sunday evening last; and the next day I proceeded to visit the spot in person, accompanied by Mr. Ruckert and Mr. J. O. Hay, both of them resident merchants of Akyab, and men of great local experience in all that pertains to the trade of this port.

3. The distance by water, about 35 miles, was soon got over, and the well reached before midday. It is not more than a quarter of a mile from the shore, and is situated in a basin, or rather the cavity formed by low ridges of surrounding hills of from 300 to 500 feet in altitude.

4. The object of my personal visit was to ascertain by ocular demonstration whether a flowing well had really been discovered, and in this respect I may at once say that both I, and the gentlemen who accompanied me, had every reason to be fully satisfied with the sight which greeted us.

5. The well at its mouth was some 15 feet in diameter, and had been dug out with those dimensions to a depth of some 30 feet. Here boring commenced, and had been carried to a depth of 36 feet only, when the workmen were surprised and terrified by a sudden outburst of gas and oil, accompanied by loud subterraneous sounds as of distant thunder. They had only time to make their escape up the ladders of the well before the oil and gas poured in in quantities which would otherwise have made their position a very perilous one.

6. Viewing the well as we did the following day, and after 250 gallons of oil had been taken out of it the same morning, the appearance was that of an ordinary water-well, from which the oil was bucketed in native fashion, and with no more difficulty than if it had been water.

7. The native workmen were in a state of continued excitement, and constantly affirmed that the supply of oil was inexhaustible, and more abundant in this well than even water in the ordinary wells of the country. The only perceptible difference in the appearance of the oil-well and an ordinary water-well was a violent agitation of the oil at the centre of the well, where the gas escaped and the oil flowed continuously from the bore-hole below.

8. It was impossible to regard this appearance without realizing in one's own mind the unmistakable evidences of really flowing well. These evidences seem to indicate that there will be a continuous flow for a sufficient time to make the well a source of considerable, profit to its fortunate and enterprising proprietor.

9. At the same time it is rather difficult to believe that a really large deposit has been reached at a depth of only 66 feet; and it is possible that the present yield is, after all, a mere surface deposit, and that further borings will be necessary before the primary petroleum beds are reached.

10. Mr. Savage's find, however, has already had the effect of giving a great impetus to a number of prospectors and others who have hitherto been somewhat incredulous on the subject of a large petroleum yield in any portion of the Arakan division.

11. To myself it is peculiarly gratifying, because I was the first to encourage Mr. Savage's discovery of oil immediately it was known to me, and have done all I could, ever since, not only to promote and push on his work, but also to bring other labourers into the field, and, by successful discovery, help the development of a new source of wealth in this portion of our Eastern dominions.

The Planters' Gazette.

TEA.

WE are informed by Messrs. Balmer, Lawrie and Co. that the London deliveries of Indian tea during last month amounted to 3,100,000 lbs., as against 2,019,000 lbs. for the same period in 1877, while the stocks on 28th February were 17,600,00 lbs., against 11,474,000 lbs.

A VERY severe storm of hail and wind visited a considerable part of Cachar on the 15th ultimo, playing sad havoc among the young shoots of the tea gardens, in which the season's picking was just about to begin, and perhaps seriously affecting the outturn of the year.

THE red spider is said by the local paper to be very prevalent in the Darjeeling district at present. There was good rain on three days last week, and tea manufacture has begun in most of the gardens; whilst, red spider notwithstanding, the prospects of the season are said to be very good so far.

LATER advices say that tea manufacture has begun on several of the hill gardens, and nearly all will be making tea within a few days. Red spider is very prevalent in the district just now.

FROM Kumaon and the other tea districts, we hear that there are prospects of an early and plentiful crop this season, if only the necessary sunshine for a few days is vouchsafed. It is likely to be a brisk green tea season, as the Central Asian traders seem willing to buy freely, although at somewhat reduced rates. Several contracts are already reported as having been entered into.

A CORRESPONDENT in the Kangra Valley writes that slight showers fell on the 14th and 15th:—"A spell of really fine and warm weather has had the effect of coaxing out the leaf, and in down-valley plantations manufacture will probably begin in ten days or a fortnight, unless any unanticipated cold should occur to check the flush. There has been a slight fall of snow on the hills." They have also been having fine tea weather at Chittagong, where manufacturing has commenced.

WE learn that tea is being manufactured now to some extent in the Terai. It seems probable that tea manufacture will begin in the hills about the first week in this month. The bushes, a fortnight ago, were beginning to bud everywhere, while on the lower and more sheltered portions of some gardens shoots fully six inches long were by no means uncommon.

WE reprint elsewhere, from a local contemporary, an interesting article on Tea Pruning by Child Harold.

AMONG other improvements in tea-cultivation and manufacture which have lately been brought forward, we have to draw the attention of tea planters to a handy little implement, called the "wheelhoe," the satisfactory working of which we witnessed some time last month in a private garden. At present planters in Assam, Cachar, and other tea districts, where labour is scarce and dear, find it almost impossible to keep down weeds, during the plucking season. A hoeing implement, therefore, by using which one man can do the work of ten, using the ordinary hoe, ought to be useful during the busy season. When the land has once been put into a state of proper cultivation in the ordinary way, it will be comparatively easy to keep it perfectly clean during the rains by means of the "wheelhoe."

The inventor supplies the following description:—"The implement may be described as consisting of a knife with teeth upon its upper surface, carried horizontally between a pair of wheels by means of arms to which these wheels are attached, and to which also are fitted the shaft and handles for working and guiding the implement. The knife is adjustable upon these arms, so that its edge can be set to project below the outside rim of the wheels at anything from one to three or four inches. The wheels act in regulating the depth to which the knife may penetrate the soil, and the earth in passing over the knife comes in contact with the teeth upon its upper surface, and thereby gets broken up and pulverized. The furrow hoed up is about a foot in width, and when the implement is adjusted for light hoeing it can be drawn by one man, but it is also so designed that where deeper work is required bullock power may be applied. It is very portable and easily moved from place to place, as it only requires to be turned over and the knife thus brought to the upper side, when the implement can be run along freely upon the wheels." Messrs. Gillanders, Arbuthnot & Co., of this city, are the agents, who will, no doubt, be glad to give further particulars.

TEA gardens are springing up in all the districts of the Chittagong Division, and but for the labour difficulty, expansion of the industry would be all but indefinite. Labour, however, is scarce, and, as a consequence, dear, having to be imported at great risk and expense. In Chittagong there are twenty tea plantations, one in Noakholly, and four in the Chittagong Hill Tracts. The area brought under cultivation in 1876-77, consisted of 1,763 acres in Chittagong, against 1,640 acres in 1875-76. In Noakholly the acreage was the same as in 1875-76, and in the Chittagong Hill Tracts it was 450, against 1,052, excluding the statistics of the Hulda Valley, whence none have been received. The total yield aggregated 148,629 lbs., or 1,857⅞ maunds, against 147,447 lbs., or 1,843 maunds in the previous year. In Noakholly, 600lbs., or 7½ maunds, against 360 lbs., or 4½ maunds, and in the Hill Tracts 46,511 lbs., or 581⅜ maunds, against 168,760 lbs., or 2,109½ maunds in the year preceding. No statistics are available from the Hulda Valley, which is the largest concern in Chittagong.

IN the Dacca district, there are only two tea gardens owned by Nawab Ahsun Oollah and Rajah Kali Narain Roy, and one in the Mymensingh district owned by the Maharajah of Shooshung. Last year, the Nawab's garden composed of 10 acres, turned out 23¼ maunds of tea, against 16¼ maunds in the year before. The Rajah's garden, consisting of 21 acres, turned out 23¼ maunds, against 42 maunds, and the Maharajah's garden of 53 acres, 44 maunds, against 67½ maunds. It would seem from these figures that the Nawab's garden is the best managed of the three in that division.

WITHIN the district of Darjeeling there were, in 1876 77, altogether 132 tea gardens, as against 121 in the year before. The total area of land included in the several concerns is 106,637 acres, of which 95,724 are held under waste land rules, or taken up under cultivation leases, and 10,913 acres are lands held on the ordinary district tenure and acquired from the Terai jotedars In 1875, the land so held and used for tea cultivation comprised 8,236 acres, and it is probable that there will be a further increase in the future, since the jotedars hold a considerable extent of land fit for tea, but less suited to other crops, while the demand for tea land is great. Of the total area included in tea concerns, 25,028 acres are returned as actually under plant, against 22,162 acres in 1875, and 14,503 in the beginning of 1873, so that within the last four years considerably over 10,000 acres have been added to cultivation. It is not improbable that a corresponding increase will go on until checked by labour difficulties, of which at present there are no signs. In 1876 the outturn of tea was 4,181,622lbs., or 52,270¼ maunds, against 4,610,758, or 57,634¼ maunds in the preceding year—a result due in the later year to a desire for the manufacture of a superior quality of tea, which resulted in higher prices and enhanced profits. There are 24 limited liability tea companies in Darjeeling, 17 associations not registered under the Act, and 70 private gardens, two or three in some instances belonging to the same proprietors. Six gardens are worked by the Land Mortgage Bank. Natives have also of late years taken to tea cultivation, and there is one company composed entirely of Bengalees, owning at least four gardens.

THE Manager of the India Tea Agency in London is now in Paris completing arrangements for the exhibition in the Indian court of tea, coffee and cinchona, the growth of India and Ceylon. We are glad to be able to announce that Mr. Burrell has also arranged to open a depôt in the Rue Scribe, one of the best positions in Paris, for the purpose of introducing during the existence of the Exhibition (May—Nov.) Indian tea to the French. In a letter received by a Calcutta firm by last mail, Mr. Burrell writes: "I have undertaken to meet all the expense, with perhaps not much chance of *immediate* profit, and I have therefore asked the tea planters here, whom we know, to take some share of the expenditure by contributing *gratis* some boxes of their teas for that purpose, their interest at least being equal to ours in opening a new market. All of them I have asked here have at once and cordially agreed, and I wish you, among the companies or plantations you represent or can influence, to urge them to do so likewise. You are aware that there is an enhanced duty on tea imported into France from Europe or in foreign bottoms, therefore anything you can so send should be shipped by the Messageries Maritimes direct to Marseilles for bond in Paris. I shall advise you next week of the exact address in Paris, but failing that, as I am officially connected with the Exhibition, a note to the offices of the British Commissioner, Inter-Exhibition, 40 Avenue Suffren, Camp-de-Mars, will reach me. Such shipments should be made to arrive in Paris for the 1st of May, but all that month will do; even later, for sale."

As it is of vital importance that the market for Indian tea should be extended in Europe, our planters should hasten to aid this effort to bring the Indian leaf into favour.

INDIAN TEA IN CENTRAL ASIA.

THE following is translated from the *Turkestan Gazette* of the 27th December 1877:—"In order to uphold and develop our trade with China *viâ* Kiakhta, and to counteract the effect upon it of the lately started importation of teas coming from India (*viâ* Bokhara), it was recently ruled to levy an import duty on the latter. But owing to the abolition of the *siaket* system (a kind of native custom house establishment), considerable quantities of Indian teas are now being sold in the Turkestan markets, as well as in those of the neighbouring khanates, which have paid no import duty at all. And whereas formerly, under the *siaket* system, the native states were consumers of Kiakhta tea, the inhabitants of the Asiatic quarter of Tashkend and the natives of other towns are now exclusively using Indian teas, which latter, owing to the absence of any control, are freely imported without paying any duty whatever. Hence the tea merchants of Vernoe and other towns on the road from China begin to experience a serious loss of trade as compared with preceding years, and complain of a state of things which is thus allowed to undermine their prosperity, although an efficient customs supervision, as regards these importations of tea from India, could be established both easily and cheaply. At present, however, the matter would seem to concern none of our authorities; and although the natives, tea-dealers, and others are quite willing to assist the administration in the enforcement of the regulations introduced for the protection of our Kiakhta tea trade, they (the regulations) are in some strange way suffered to remain a dead-letter."

TEA SEASON.

WE take the following from Messrs. Balmer, Lawrie & Co.'s Tea Report, dated 15th March 1878:—

THE reports from the producing districts promise an early opening of the new season, though it is probable that manufacturing will not be generally commenced for some little time, as experience has shewn that early plucking to any extent; checks the yield in the later months.

ASSAM.—DIBROOGHUR.—February was in this neighbourhood marked by very extraordinary weather, being cloudy and drizzly almost throughout, with an occasional shower, and at times a high northerly wind and hail, very favorable for transplanting, but retarding other cold season operations. Jaipur.—There was more or less rain every day: all that could be wished for transplanting. The mild temperature had also induced a very early flush, and unless checked by adverse weather, an early season may be expected. Rungagoora-road.—Continuous small rain, with occasional heavy showers, fell throughout last month, accompanied by strong cold winds. A hailstorm occurred on the 28th, with enormous hailstones, but the damage done was nominal. The early rain had started the sap in the bushes, but the cold winds kept the flushes back. Seebsaugor.—The hot weather was setting in fast, the thermometer marking 81° in the shade; rain fell to the extent of two inches about the middle of the month, and the succeeding hot sun was bringing the leaf on fast. The season has been most propitious for nurseries. Nowgong.—We have to chronicle an unusual dryness both of soil and atmosphere, less than three inches having fallen since September.

CACHAR—Has had very favourable weather for bringing out the flush, and manufacturing had been started on a small scale, just to keep the bushes in trim. We regret to hear that blight is reported from some districts.

DARJEELING.—Leaf is reported to be coming out on the hills, but rain is much wanted to bring out a satisfactory flush. In the Terai, pruning was about finished at the close of the month; some light showers of rain had fallen, and were succeeded by hot sunny days. Plucking had commenced to a small extent early in March, and as the sap was rising fast, a fair flush may be expected about the end of this month.

DEHRA-DHOON.—Cold northerly winds prevailed during the month, accompanied by occasional rain. About the middle of the month the temperature became more genial, and the sap was fast rising; prospects were good as far as tea is concerned.

CALCUTTA.—The recent sales have been of an unimportant character, consisting of the balance of last season's teas, and consequently the quality offered was generally undesirable; the last sale was held on the 4th instant, when about 4,500 chests found buyers; prices all round were higher, especially for Low Brokens, which commanded an advance of quite an anna per lb. Auctions will probably be again held next week, when it is said that some new season's tea from the Chota Nagpore district will be catalogued.

	lbs.
The exports for the season to end of February are	31,116,428
Against 1877	26,791,705
" 1876	22,570,362

Comparing this season with last year, these figures would point to a total export of about 32,200,000 lbs. It is said, and probably with truth, that planters purpose this year to manufacture chiefly for quality, and we are sure that the news will be welcomed by all connected with Indian tea, either as proprietors or consumers, though some people seem to think that a mistake will be made in running to extremes, and that we shall have nothing but fine teas to market, but we think such persons must be of an unusually sanguine turn of mind. Looking at the trade as a whole, it is in quality that India holds an unique position in the tea market, and we are persuaded that it is by quality that she will distance her competitors. Though it is no doubt true that in the improbable event of nearly all the crop consisting of fine teas, the best paying gardens will be the few that produce a fair medium quality.

LONDON—Reports shew that teas of point and quality were realising full rates, while the less desirable grades were quiet. Broken Pekoes from 1*s.* 11*d.* to 2*s.* 3*d.* were in request at 1*d.* per lb. advance. We cannot commence this new season without repeating our protest against the unfair difference made in the London Market between sales of Indian and China teas. If the trade at home really wish to encourage larger breaks of Indian sorts, they must offer them in small lots, say of 6 to 9 chests, so as to open the market to the smaller buyers, and induce a proper competition for the article. We are glad that one or two of the London papers connected with the trade have taken up the suggestion, and we hope the trade will soon make the necessary alteration in their custom. There can be no possible objection to Indian teas being also offered for sale privately.

The recent deliveries of Indian sorts in London have been on a most satisfactory scale, *viz.*:—

		1876-77.	1877-78.
December	...	2 000,000	2,480,000
January	...	2,377,890	3,200,000
February	...	2,019,000	3,100,000
Total	...	6,396,890	8,780,000

shewing during three months an increase of 2,383 110 lbs, which is a very satisfactory feature. Stocks on 28th February 1878 were 17,600,000 lbs., against do. 1877 11,474,000 lbs.

TEA SEED.—There is hardly anything doing in seed, but sellers are not disposed to make contracts at low rates.

FROM the same firm's Tea Report, dated 29th March, we learn that—

The prospects of the season so far, judging from the news from the growing districts, are of a very promising nature. The season has begun in most of the provinces at a much earlier date than last year, and the weather being generally favourable, we are in hopes that the season will produce a fair quantity, and that the quality will be better than last year. The estimates have not yet been completed by the brokers, and it would be idle to speculate on what they may be, but we hear that many concerns have estimated a smaller quantity than their output for last year, with a view to produce only fine teas. We subjoin our usual detailed weather reports from the producing districts.

ASSAM—DEBROOGHUR—Has experienced very suitable weather for transplanting operations and for putting out seeds; some hail, however, had fallen, and done a little damage to the young shoots; later advices report cooler weather, which had somewhat checked the flushes. Seebsaugor—Advices mention that during the early part of the fortnight under review very cold winds prevailed, but latterly the temperature had become much warmer, the thermometer registering 82° in the shade; the leaf was coming on very fast and strong, and plucking was about to commence. At latest dates the weather was everything that could be desired. Nowgong.—A considerable fall of rain having occurred, prospects were much brighter in this district, and manufacturing was expected to begin immediately. North Luckhimpore.—Fine showers of rain were being experienced almost every night, with sun during the day, so that leaf was coming out rapidly.

CACHAR.—The temperature had been unusually hot for the time of year, as high as 86 degrees in the shade having been recorded. Some parts of the province has been visited by severe hailstorms, which had cut up a few gardens, though the damage had not been very serious; rain had fallen to a fair extent, and with the hot sun during the day, leaf would come on quickly.

DARJEELING—Manufacturing had commenced on several of the hill gardens, and nearly all are probably making tea by this date; the prospects of the season are very good so far. From the *Terai* we learn that two showers of rain had fallen, with hail in some places, but more was wanted, the weather generally having been very dry and hot; most gardens had commenced plucking.

CHITTAGONG.—During the first week of the month a rainfall of about two inches was registered, and some parts of the province had been visited by hail; manufacturing had fairly begun, and prospects generally were good; the temperature was very warm, and there was promise of an early setting in of the rains.

DEHRA-DHOON—Has had cloudy and mild weather, accompanied by a few light showers; the temperature was becoming warmer, and the bushes were breaking heavily. More rain, however, was required.

CALCUTTA.—The market here is almost at a standstill, the only sale during the fortnight having comprised but 1,650 chests, which fetched higher rates all round, especially for low broken descriptions. The first parcel of new season's tea, consisting of ten half chests from the Chota Nagpore district, was offered, and realised Re. 1-8-6 per lb. There is now hardly any old season's tea remaining undisposed of.

TEA-PRUNING.

By Child Harold.

ALTHOUGH it is about a quarter of a century since the cultivation of tea began in India, only a few years, so to speak have elapsed since tea first began to be seriously looked upon as a garden crop, and to have the commonest principles of horticulture practically applied to it. The idea that formerly for years guided tea planters appears to have been that tea was a kind of forest crop on which high cultivation would be thrown away. Hoeing and manuring were likely chiefly to stimulate the growth of rank grass and weeds that still disputed possession of the soil (usually only too successfully), with the Chinese exotic, to the success of which they were looking for the realizations of their fortunes. In consequence of their attachment to such ideas, they did not consider a practical acquaintance with farming and gardening as of prime importance in the management of a plantation. Great energy, no doubt, was often displayed in planting out tea bushes, but none whatever in caring for them afterwards. Nothing was done to encourage the development of the bush whereby the yield was to be obtained; the practice was, thankfully, to collect what leaves the bushes might yield, and by the aid of a Chinaman (who might or might not have had anything to do with tea-making in his native country) to convert the latter into as good tea as possible. Among the ordinary operations of gardening in respect of which tea had been, until a few years ago, quite neglected is that of pruning. Many will say that pruning was practised all along, and to the then simple mind of the planter no doubt it was. A barbarous mode, I believe, was in practice, *i.e.*, going over the bushes with a pair of shears—the manager, baboo, or whoever he was, giving each coolie a stick; this he was instructed to place in the centre of the bush, and to cut it off to the same height. This, of course, bruised the ends of the young shoots to such a degree, that they, in most cases, died for two or three inches below the place they were cut at, and in many instances destroyed the plants altogether. The planter of Assam during this benighted period was still more in the dark as regards the science of pruning; *his* mode of operation was to arm each coolie with a huge knife and a block of wood, and instruct him to gather the branches into one hand, bend them over on the block, while with the other he severed a foot or so from off the top of the bush with as scientific a flourish as possible. This was called pruning; however, I am glad to know that these doings are of the past, and on the *rationale* and practice of pruning I would now venture to submit a few remarks.

In many gardens in '70, '71, and even in '76, you could see pruning carried out with the knife much worse than during the shear period. I have seen a garden, where the bushes were on an average four feet high and two feet in diameter, operated upon in a manner that would have made any man mad, who had had even the slightest idea of what the bush required to develop it into a good leaf-producing plant.

A few remarks, therefore, upon the facts and principles on which the operation is founded might be of use as guiding to a correct practice; and, before going further, it will be necessary to consider briefly the structure of the stems and leaves of plants, and their mode of nourishment and growth.

The organs of flowering plants may be divided into vegetative and reproductive. The vegetative organs are those by which the life of plants are sustained, and by means of which they grow. They consist of root, stem, and leaves. The reproductive organs (consisting of flower, fruit, and seed) are concerned with the continuation of the species by the production of other varieties, and they are supported by this plant for this purpose. It is with the former set that we are now chiefly engaged; the structure of each and all of these parts (however much they may differ from each other in texture and external appearance) is fundamentally the same. Each consists of an agglomeration of vegetable cells. The vegetable cell, which is thus the ultimate elements of vegetable anatomy, consists typically of a very minute spherical closed sac, with certain fluid and occasionally solid contents. It is in fact a tiny bladder filled with fluids and solids, the membrane being thin enough to allow the passage of fluid through it; but although typically spherical in form, cells are rarely so in fact. Some are developed into ducts and cylinders of various sorts for the transmission of fluids in the stem and leaves; others are lengthened out into spindle-shaped bodies, and made up into small faggots for the formation of wood; many are flattened brick-like forms for the construction of bark and into tiles for smoothing off the surfaces of the leaves, while an immense number are used as packing material or padding, and are stuffed wherever there is a blank to be filled up in the internal structure of leaves. The pith of young plants is also made up chiefly of cells squeezed into a variety of shapes by pressure; but modified as they may be in form and function, they all remain essentially cells, and, while young, the walls of all have the property of giving passage to fluids and gases. The cells in old wood, however, are exceptions, as their walls having become thickend, and their cavities obliterated, they are nearly, if not entirely, impermeable by fluids. If the stem or branch of a tea plant be cut across and examined with the naked eye, the following parts will present themselves:—In the middle of the stem, if it be an old one, there will be seen a cylinder of hard wood; outside this a circle of green young sap-wood, and encircling all the layer of bark. When examined microscopically, the central cylinder of wood is found to be formed chiefly of spindled-shaped cells laid close together vertically, and with these tapering ends overlapping. In old wood, as has just been said, these have become incapable of transmitting fluid, and, therefore, of performing any vital function, and the wood formed of them is useful to the plant merely as a mechanical support. This explains how trees that have become hollow from the decay of the wood in the centres of their stems can continue, nevertheless, to throw out leaves and to yield flowers and fruit. The structure of the encircling layer of young or sap-wood differs in no way from that of the hard wood, except that the walls of the spindled-shaped cells, of which it mainly is composed, are thin and pervious to fluids, and the cavities of the cells are themselves filled with fluid.

In stems of plants that have not attained a sufficient age, no central cylinder of hard wood will be recognizable. The whole of the woody tissue will, in such stems, be found to consist of sap-wood, which will, however, be of greater density towards the centre. When the sap-wood is cut across, a greater or less amount of fluid will at certain seasons exude; and this is the layer which, in the language of gardeners, "bleeds" if cut while the sap is rising. Outside the ring of sap-wood is the bark which is composed of several layers, the inner of them being vascular and affording passage to fluids, the centre mainly protective.

The woody parts of the root of a tea plant being in reality merely stems situated under ground will be found to resemble the setm proper in structure. The real roots consist not of the woody parts which give more mechanical support, but of tender fibrils which proceed from these. These fibrils are composed of celular tissue permeable to fluids; and, as will be seen presently, they are the chief means by which a plant collects its food.

The leaf which is [illegible] but a flattened expansion of the branch, and which retains an organic connection with it, consists of a mass of loosely-packed cells confined between two cellular membranes (which form the skin on its upper and lower surfaces) and penetrated spreading bundles of fibres and vessels—the so-called "veins"—derived from the branch. These loosely-packed cells, as well as the vessels of the leaf, are freely permeable by fluids. The root, stem, and leaves, of which the above is a rough account, form the organs of a plant's digestion and assimilation, and therefore, of its growth. The material of its food must now be considered, also the mode in which these materials are taken up and digested.

Plants cannot take in solid food. Whatever they absorb must be offered to them either as a fluid or a gas. The gaseous food of plants, in as far as it is absorbed in the state of gas, may be omitted from particular consideration at present. It is in the form of fluid that the great bulk of their food is taken up. This fluid consists of the natural moisture of the soil, the various salts of the earth, and of a manure which that moisture may hold in solution, and is absorbed by the delicate root fibrils which radiate in all directions in search of it.

Collected from the soil by the fibrils, this undigested fluid is conducted to the stem where, avoiding the hard heart wood, it passes into the part described above as the young or sap-wood layer; and, transmitted from cell to cell, passes upwards through the main stem along this layer, enters the corresponding layer in the branches, and finally reaches the flattened expansions of those we call the leaves. This ascending undigested fluid is known as the crude sap. Having reached the leaves, and there becoming exposed to the influence of light and heat, this sap parts with a large amount of water by evaporation, and undergoes certain chemical changes. Thus altered in character (and as it were digested) by the processes to which it has been submitted in the leaves, &c., the sap is now no longer crude, but has passed into the condition in which it can be directly assimilated as nourishment by the cells of the plant. Up to this point the sap had been transmitted upwards in obedience to certain physical laws; and, during the upwad passage, probably no nutritive functions had been fulfilled by it. Before parting with the fluid which they have thus elaborated, the leaves retain as much of it as they require for their own nourishment and growth, and the remainder they return to the branches and stem mainly through the vascular tissues of the inner bark, *i.e.*, the ring immediately outside the cambium. Passing downwards, through these vessels as its main channel, the elaborated sap is distributed into all growing parts of the branches, stem, and roots, and in fact affords to these, as to the leaves, the material of their nourishment and growth. It is thus clear that the leaves are organs of very great importance in the economy of a plant's life; and, indeed, in the mutual interaction of these and of the roots its life may be said to consist. The truth of this is illustrated in the structure of the seed, which in the class of plants to which tea belongs contains the rudiments of two leaves and a root, with sometimes a little store of nourishment in addition. The parent plant supplies these to its offspring to enable it to start in life; and the very first thing the offspring does, when in the act of germination it begins life on its own account, is to send the two embryonic leaves upwards, and embryonic root downwards, and so begin the mutual process abovementioned, thus becoming a living thing.

(To be continued.)

TEA AND COFFEE PLANTING IN THE STRAITS.

MR. WALTER KNAGGS, a planter of Province Wellesley, and whose name may not be unknown to our readers in connection with the agricultural resources of Perak, has addressed a very interesting communication to the *Penang Gazette* respecting the prospects of tea and coffee planting in the Straits:—"My own confidence," he writes, "in the prospects of tea cultivation in the Straits is undiminished, the more especially as I have introduced a plan by which it may be planted jointly with another article of Colonial produce, which, being gathered at the end of 18 months, will leave the tea established for nothing! This plan I have already tested, and I find it to answer completely The Malay Peninsula, from the Province to Singapore, contains millions of acres of low, undulating, thickly-wooded hills. These are tea lands; and the soil of which they are composed tallies with the description that I have read of many of the most favourable tea soils in India. The variety to be planted must be the indigenous Assam and no other. With cheap land, plentiful labor, regular seasons, and easy transport—all of which we have here—I think that we possess advantages unequalled elsewhere; and I hope soon to see this cultivation largely extended. In fact I see no other permanent cultivation suitable for the lands in question but that of tea or coffee. Tea, however, has been made on the estate which has realised in the home market the price of that of Assam, and which has been declared equal to it in every respect; but anticipating the great demand for seed which will probably arise, the trees are now being cultivated for that purpose, as it is not advisable to make leaves and seeds from the plant at the same time."

This would seem to be conclusive, remarks the *Strait Times,* that tea can be grown in the Peninsula. Mr. Knaggs is a planter of experience, and although he may be perhaps a little sanguine, he has actually succeeded in growing tea, and his opinions are endorsed by others, eminent planters from India, and also by two of our own officials, the late Mr. Birch and the present Colonial Secretary, whose knowledge of planting in Ceylon ought to have qualified them to judge. It is interesting to note that the coffee planters of Ceylon have been turning their attention to tea cultivation, stimulated by the great success of the tea planters in Assam and other parts of India. The following table shows the progress made in Ceylon during the last five years.—

Exports of Ceylon-grown Tea.—

Year.	Ceylon produce.	Customs value.
	lb.	
1873	23	58 R.
1874	192	1,903
1875	1,438	2,420
1876	757	1,907
1877	2,105	--

It will be seen that the progress has been but slow. The *Ceylon Observer*, however, says that there are now over 2,000 acres planted in Ceylon, half of them two years' old and upwards, and that at least 100,000 lbs. of tea may be expected to be prepared during 1878. One of the Ceylon planters, indeed, has so much faith in the adaptation of the tea plant to the Ceylon soil and climate, at any elevation from sea level to 7,000 feet, that he believes there will be as much tea planted in the island at the end of ten years as coffee. The success of the Ceylon planters should be an encouragement to enterprise in the Straits. Mr. Knaggs may be said to have demonstrated that tea can be grown beautifully in the Peninsula, and indeed, for that matter, there seems every reason to believe that it might be grown in the island of Singapore, if it were set about properly. The soil of Singapore may be said to have been, until recently, very much under-rated; but it has been now demonstrated that not only pepper, tapioca, and sugar, can be grown upon it and made to pay handsomely, and why should not tea, which is a hardy plant? At all events, there is no question about the Peninsula, and we apprehend that the great and real difficulty will be, not as to the growth of the plants, but as to the proper preparation of the leaf.

Mr. Knaggs closes his letter to the *Gazette* with a paragraph respecting the cultivation of coffee, in which he states that he has seen trees without any care bearing profusely and in excess of anything to be seen in the West Indies. 'And no doubt,' continues Mr. Knaggs, 'they would all bear equally well were they carefully put in the ground and regularly cultivated and pruned. I am sure that if this were done, a strong, healthy, and durable plant, with a plentiful crop in regular season, would result. The Rajah of Quedah has establised a large coffee property; and I hear that he has over 300 acres planted, and that they are yielding splendidly. I had also commenced an experiment in the Province; and up to time of my leaving the plants had a very promising appearance."

COFFEE.

LIBERIAN COFFEE.

TO THE EDITOR.

I.

Sir,—Can you put me into the way of getting a small quantity of Liberian coffee seed, for experimental cultivation on the Jynteah hills, at an elevation of 1,200 to 1,500 feet? For any help you can give me in this matter, I shall be greatly obliged.

H. W. BROUNLOW.

Sundye, Feb. 21st, 1878.

NOTE.—Apply to the Director, Ceylon Botanical Gardens.—ED., *I. A.*

II.

Sir,—Can you inform me, what area it is necessary to allow, in planting Liberian Coffee.

Is shade always requisite, or merely when the tree is first planted out?

I shall feel much obliged by your kindly giving me this information, of in your power to do so.

H. W. NEWTON.

Calcutta, 6th March 1878.

NOTE.—The Liberian coffee tree does not produce well under shade either in the quantity or quality of the crop. When the trees are not large enough to shade the ground with their branches and fallen leaves, they should either have shade from forest trees or be *mulched* in the dry season, that is, their roots should be covered with dry grass, straw shavings, or anything capable of shading them, but the leaves and branches should have influence of the sun to elaborate a due proportion of sap into fruit buds. The Liberian coffee when well established does not suffer from the tropical sun. *Mulching* in the dry season is generally requisite for very young trees on dry hilly slopes.

Both close and wide planting are adopted. Some trees are planted close (six to eight feet), while others are planted at great distances (ten to twelve feet). When trees are planted close, so that they meet, they thrive and bear well, provided their leaves and branches have the influence of the sun. There is also this advantage, by shading the ground they prevent the grass from growing, and thus save the expense of weeding. But it is very inconvenient to pass among them for the purpose of gathering the crop, pruning, manuring, &c. Even at the distance of twelve feet, if the trees are topped and kept down, they will eventually meet.—ED., *I. A.*

THE latest news regarding Liberian coffee from Mausawa Estate is that the estimate for the Liberian trees in bearing, equivalent to a ton an acre, is found to have been much below the mark. Now that the crop is all picked, the result is found to be nearer two tons per acre! We should like to have this information confirmed.

WE hear from Ceylon, that during the dry season there will be more land burnt off for Liberian coffee, cinchona, and tea, to say nothing of cacao, than there will be for coffee cultivation. The two extremes of altitude have now been reached; and whilst burns are taking place around the base of the lofty Pedrotallagalla, they are equally common on the banks of the Kelani and the Kalugauga.

WE hear from the Southern Provinces of Ceylon that there have been already 10,000 acres of land taken up for the cultivation of Liberian coffee in and about the Galle district—a sure proof of this new branch of industry becoming of considerable importance in the list of island cultivations.

LIBERIAN coffee is attracting attention in Guatemala. Several cases of plants, consigned to a prominent foreign resident of that Republic who is largely interested in coffee culture, went forward by the steamer *South Carolina* from Panama on the 29th November last. The experiment is looked upon with great interest. The official paper, *El Guatemalteco*, of a late date, contains the translations of an article from the *Trinidad Royal Gazette* of May 30th on this important subject, from which we conclude that the Government of Guatemala, amongst its many other efforts to benefit the country, takes a lively interest in this new plant, which promises so many benefits.

HINTS ON LIBERIAN COFFEE.—"If planted on sloping ground, precautions should be adopted to prevent the surface soil from being washed away, since the fibrous roots always keep near the surface. With regard to soil, a loose, rich earth, such as the mould of a virgin forest, is most suitable, since it contains a large amount of nourishment for the plants, and obviates the expense of manuring for several years. The plants will not thrive in stiff clay. Although the Liberian coffee does not appear to be attacked with the coffee fungus (*Hemileia vastatrix*), yet it is advisable to prevent the introduction, as far as possible, of any growth of that kind. A source of these pests (fungi) which is often overlooked has been pointed out by Dr. M. C. Cooke. It consists in allowing the stumps of old trees to remain and decay in the ground. All trees shewing any tendency to die should be immediately removed, and destroyed by fire at a considerable distance from the plantation, care being taken also to remove the roots and the surrounding soil as much as possible. Indeed it is best not to put fresh plants in the ground where a diseased plant has died."

THE export of coffee from India to Arabia, appears to be a regular trade. Mr. O'Conor, of the Commerce Department, has been told that it is sent to Arabia both from India and Ceylon in mat-bags to simulate the packing of Arabian coffee, and that some of it is brought back to Bombay for sale as Mocha coffee. Perhaps some is re-exported elsewhere in the same way. It is certain that Indian and Ceylon coffee is quite as good as much of that which is produced in Arabia.

FROM the Ceylon coffee districts we hear that the coming blossom promises favourably, though it is pretty certain that it will be late. There has been no blossom anywhere as yet, save in the low districts, and even there it has not been abundant. The planters' hopes are therefore centred on a March blossom, and in some districts it may be as late as April. The old crop is now nearly all in Colombo. Leaving little more than the Ouvah spring crops to come in, and they are not expected to be large, so that there is not a good prospect of exceeding cwts. 550,000 for the season's shipments.

THE TRAVANCORE COFFEE CULTIVATION COMPANY.—The capital is £100,000 in £10 shares, and debentures bearing 6 per cent., and issued at 90, amounting to £40,000. Messrs. C. B. Dowden & Co., of Tuticorin and 19, Cullum St., are the Managing Agents and vendors of part of the property to be acquired by the Company, Mr. W. Barclay Miller, and Mr. B. Fox Overbury, and Mr. T. Clarke are the other vendors, and both have seats upon the Board. The objects of the undertaking are thus concisely stated:—"To acquire, cultivate, and develop a group of coffee estates situated in the Alwarcoortchie valley, Travancore, South India, comprising the following properties.—

Hereford Estate	Acre 372	
Linwood do	355½	
Ellerslie do	467	
Goatwell do	357½	
		1,552
Coomsole do	403	
Rosemount do	463½	
		865½
		2,418½

HYBRIDIZATION OF COFFEE PLANTS.

A CORRESPONDENT to the *Madras Times* writes:—Has the idea ever occured to you, or any of your readers, whether *Coffea Liberica*, grown in or near an estate of *Coffee Arabica*, could not get hybridized, and the former partake of the weakness of the latter, and *vice versa*, especially if both were in bloom at the same time? Seed-growers in England could, no doubt, enlighten us on this subject.

With reference to this inquiry, a competent authority writes:—"The plants of the two varieties of coffee, if growing in close proximity, will be very liable to yield a produce which will produce plants that will partake of the character of both parent plants; but whether this will be an evil, will depend greatly on circumstances. Some hybrids are more valuable for certain conditions than either of the varieties from which they have sprung. For instance, the hybrid tea plant now so largely cultivated on the Nilgherries, is considered by many to be a more valuabe plant for the conditions met with on the Neilgherris than either the China or Assam trees, to a cross between which it owes its origin. If your correspondent wishes to produce seed of the Liberian variety for raising crop, it will be necessary that the Liberian tree should not be grown near trees of the common coffee, as the product cannot be relied on as being true to kind. Hybridization depends, however, on other conditions than the mere proximity of plants, in bloom of different varieties of the same family; some plants will not hybridize except through the intervention of certain insects which are not always present."

COFFEE IN THE WYNAAD.

WRITING in the middle of last month the Wynaad Correspondent of the *Madras Times* says:—It is rather amusing to notice how experience changes opinions with regard to coffee-planting as well as in other matters. Two or three years ago, when the shade question was becoming a topic of universal interest amongst us, there were many who were most strongly in favour of the charcoal tree as a shade. It is a very quick-growing tree, and plants itself in profusion unless checked. In less time than one could suppose possible it covers the ground so thickly with its shade, that, at any distance, the estates under it look more like an even-topped jungle than anything else. This appearance became the pride and delight of those who, possessing it, believed that charcoal was "the finest shade out." But experience apparently has much altered their views on the subject, and it seems pretty well proved that charcoal shade not only damages, but, in many cases, entirely destroys the coffee, which it was supposed to protect. The consequence is that, on all sides, we see these young jungles being ruthlessly destroyed, and it is surprising to notice how the coffee improves after their removal. I do not think, as far as I have been able to remark, that the various figs planted some two years or so ago have grown as quickly as was at first expected, though, where they have succeeded well, they have fulfilled anticipations by proving very desirable as shade. Very many people are planting cinchona largely for the same purpose, and, of coure, thereby combining several advantages: first that of shade, then the quantity of large leaves which fall from them, and, like the jack leaves, from excellent manure, and last, but certainly not least, the cinchona trees themselves, which every year must add so considerably to the value of the estates.

I hear of sundry new openings to be commenced this year; this is very encouraging, and shews that hope has by no means yet died out amongst us. Some of the young clearings about here planted last monsoon are, in spite of the drying effects of sun and wind, looking most charming; one which I especially noticed a few days ago was a sight to make glad the heart of a planter, not only from the straightness of the lines in which it had been laid out, but also from the evenness and vigorous greenness of the plants themselves. Tea is also being tried in small quantities, more as experiments than anything else. It seems a terribly slow-growing thing, and the preparations being so utterly different to that of coffee, and so much more elaborate, will, I should fancy, in a great measure prevent its being generally cultivated in Wynaad, at any rate for some time to come. Our rain, alas, has vanished; the clouds were so hopefully heavy last week that we quite thought they were coming down in a good shower, and we now watch the pitilessly blue sky with anxious eyes. The coffee up to the present seems to be bearing the heat bravely; the spike in our neighbourhood is hardly sufficiently forward to be much affected, and if the showers will only come soon, our mental barometer will have good reason to rise considerably.

The general meeting of the Association came off at Pookote. The gathering was nothing like so large as that held in October last, but it was hardly to be expected. All the doings since then were discussed, and a short universal rejoicement held over the coffee stealing ordinance. The fact that our long hard fight has actually had such palpable results is almost too much for the mind of a planter to realize! It is indeed a grand step in the right direction, and we may hope only one amongst others which we shall obtain to help us up the ladder of prosperity. We do deserve it, for if we have not displayed altogether unresisting patience, we have, at any rate, been "long-suffering." The great gold meeting which was to be held in Davala has, I hear, been put off, and is now to be held in Ootacamund for the greater convenience of those most concerned in its results.

COFFEE-LEAF TEA IN SUMATRA.

THE only non-intoxicating drink the Sumatran does believe in is coffee-leaf tea, and his faith is founded on experience. Give him a little boiled rice and plenty of coffee-leaf tea, and he can work for weeks together in the rice fields, up to his knees in mud, scorched by a burning sun, or drenched with tropical downpours. Heat, cold, and wet are alike to him, for they work him no harm, and he ascribes his immunity entirely to the virtues of his favourite beverage. Mr. Motley, travelling up the Chanaku river, saw coffee trees growing everywhere near the houses, and in every case noticed that the berries lay decaying on the ground, as though not worth consideration. He was induced to taste the liquor of the coffee-leaf, which smelt like green tea, and found it so pleasant to drink, and so refreshing after a hard day in the sun, that he no longer wondered at the excessive fondness the inhabitants display for what is truly their national beverage. Mr. Ward, who passed twenty years in Padang, is loud in its praises. He drunk it morning and evening, and found it invaluable, giving immediate relief to hunger and fatigue, and clearing their brain of its cobwebs.

When grown for its berries the coffee plant can only be cultivated successfully in particular soils and particular situations; but when it is only required to yield a good crop of leaves, it can be profitably grown wherever the soil is tolerably fertile. The Sumatrans consider that the best liquor is obtained from the leaves shed by the plants; but their usual method of procedure is to take off the ends of the branches and suckers, and break them up into twelve or fifteen inch lengths. These are fixed side by side in a split bamboo, so that the leaves all appear on one side, and the stalks on the other, by which means equality of roasting is insured, the leaves being roasted together, and the stalks together. After tying up the bamboo, the truss of leaves and stalks is held over a smokeles fire, and kept moving about, so as to roast without singing it. The stalks are considered quite as valuable as the leaves, and when the operation is completed leaves and stalks are rubbed between the hands into a course powder, and then they are ready for use.

Some examples of coffee-leaf tea were shown at the Great Exhibition, and were favourably reported upon both by tea-tasters and analytical chemists, the latter pronouncing it to contain all the characteristics of the coffee bean, while richer in theine. The infusion is of a deep brown colour, and extremely fragrant; its odour, like its taste, resembling that of a mixture of tea and coffee. Dr. Stenhouse says:—"The infusion of the coffee-leaf has a much greater resemblance to that of tea than to a decoction of the coffee-leaf; so that, should the coffee-leaf ever come into general use in European countries, it will be rather as a substitute for tea than for coffee. If the leaves were only dried at a somewhat lower and better regulated temperature, I have little doubt that they would yield an agreeable beverage."

CINCHONA.

WE hear from Ootacamund, that a seigniorage is to be fixed on moss growing in the Government Sholas, which till now used to be gathered free. The increasing demand for moss on account of the cinchona plantations probably led to this result.

ACCORDING to the Budget Estimate for the Government Cinchona Plantations on the Nilgiris for 1877-78, the amount of revenue anticipated is Rs. 1,53,425, the expenditure being placed at Rs. 69,400. The average rate for the bark is set down in the estimate of receipts at Re. 1-8 per lb. The receipts of the current year will, however, be much in excess of the estimate, as unusually high rates have been obtained at the earlier sales in London during this financial year.

MR A. McC. WEBSTER, the Acting Commissioner of the Nilgiris, in a recent despatch to the Secretary to Government, forwards copy of a letter from Mr. Mowson, the Assistant Superintendent of Neddivuttum Cinchona Plantation. The only seeds available for distribution are, we hear, that of the *Officinalis* and *Succirubra* varieties. Last year 143 oz. of seed were distributed gratuitously, against 55 in the preceding year, and from the 1st April last to date 1,372 oz. have been distributed. Government has been asked to obtain a supply of *Cinchona calisaya* seed from Java; for although the tree has not hitherto proved a success at Niddivuttum, it is believed it may do better in Wynaad.

MR. CROSS, whose name is well known in connection with our cinchona plantations, has been employed in collecting plants of two valuable species of cinchona plants, namely, that known as the *Calisaya de Santa Fé*, and the *C. Cordifolia*, in the forest of Columbia. He penetrated to the unexplored banks of the river Caqueta or Japura near its source; and having made a good collection of plants of the *Calisaya de Santa Fé*, he returned with them to the town of Popoyan on the 22nd of last October, having successfully surmounted the great difficulties which such a perilous journey entails. On the 26th he again left Popoyan for Paniquita and Syloia to make a collection of the *C. Cordifolia* yielding the "hard Cathagena bark" of commerce. He intended to remain in the Popoyan district, in order thoroughly to establish the plants until the beginning of January, when he will return to England, whence the plants will be forwarded to the cinchona plantations in India. We hear now that the plants, with a report on the *habit* of this particular species of cinchona, will shortly be sent to India.

CINCHONA CULTURE IN JAVA.

THE following is the report on Government cinchona culture in Java for the fourth quarter of last year:—"The extension of the plantations was stopped in the middle of November on an order being received to that effect. The sale of the cinchona crop of 1876 gave a net yield of almost 167,000 guilders. The expenses of the undertaking amounted to guilders 57,444·15 for the past year. In 1877, 100,178 Amsterdam pounds of cinchona bark were collected, of which 96,685 A lbs were set apart for sale in the Netherlands, 3,130 A lbs. for the medical service in Netherlands, India, and 363 A lbs. for the Paris Exhibition. The last portion of the harvested bark was forwarded to Batavia in November. *Ledgeriana* seeds are no longer on hand. The crop of these seeds has failed, so that the many applications for them can only be sparingly satisfied. Much of the fruit did not become fully ripe, and dropped off withered, probably in consequence of the very early setting in and long continuance of drought. The outlook for next year is more promising; for besides the hundreds of already seed-yielding trees of known value more than 200 are now in flower for the first time. The fruit from the latter will, however, not be ripe before July and August, and till then no more *Ledgeriana* seeds be supplied. The disease causing Hemiptera showed themselves very rarely during the past quarter, and hence at present very little of the cinchona rust is perceptible in the plantations. Chemical investigations have again led to the finding of a number of *Ledgeriana* with a great yield of quinine, amongst which is one containing 12,300 of pure quinine. Furthermore, several analyses of different kinds of cinchona confirm the opinion that the alkaloid yield from the bark diminishes proportionately as the inner layers of bark are examined, and shew us that the outermost layer of bark, which often comes off from old trees, contains a great deal of alkaloid. *From American barks this layer was often purposely taken off and thrown away. Other* determinations of alkaloids were made for the benefit of the experiments begun in the early part of the year with the so-called "mossing system," whereby the trees are partially stripped of bark and afterwards covered with moss, under which in two years harvestable bark will be formed. In the prepared ground, 18,660 *Ledgerianas*, 4,000 *Officinalis*, and 3,500 *Succirubras* were planted during the quarter.

INDIAN CINCHONA AND ITS ALKALOIDS.

DR. KING, replying to a paragraph, in one of our contemporaries' columns on Indian cinchona barks and on cinchona febrifuge, in which the authority of an anonymous chemist is given in support of two propositions—first that the cultivation of cinchona bark in India is a failure; second, that the cinchona febrifuge manufactured from the bark grown in the Government plantation in Sikkim is a remedy of little or no value in malarious fever, writes as follows:—With regard to the alleged failure of the cultivation, I would observe that if the quality of Indian grown bark be taken as a test of success, we have the authority of the great English quinologist, Mr. Howard, for believing that some of the richest barks, of which there are many analyses on record, were grown on the Government plantation at Ootacamund. If, however, instead of depending on the analysis of particular samples in the laboratory, we take as an index of value the prices paid for bark by dealers in London, we find that the Madras Government's Neilgherry red and crown barks have steadily brought prices far in excess of any South American sorts. I have now before me the particulars of bark sales held during the past two and a half years by the great bark brokers of Lime-street, Messrs. Jenkins and Phillips. Taking a sale at random I find that on 5th April last 159 bales of Neilgherry Government bark brought from 5*s*. 1*d*. to 11*s*. 8*d*. per pound, while 18 bales of very superior bark from the same plantation brought as much as 15*s* 7*d* a pound. At the same sale the highest prices got for American bark were 6*s*. 1*d* for some soft Columbian and 9*s*. 9*d*. for a batch of Calisaya. The lowest price got for any Indian bark at that sale was 3*s* a pound, while a large lot of mossy Lima (American bark) could not find a purchaser at sixpence. The highest price that I can find quoted for any Ceylon bark is 10*s*. 2*d* for a consignment consisting of a single chest the highest price realized for a large quantity being 6*s*. If cost of production be taken as a test of success, I would point out that on the Sikkim plantation, of which the accounts are regularly published the bark crop of last year is shown to have cost less than sixpence a pound—a figure at which it is impossible to lay down fair cinchona bark at any South American port. As for the cinchona febrifuge produced at the Government plantation in Sikkim it is quite true that it is, as the anonymous critic points out, not so white as quinine. But because the powder is of a pale buff colour, it hardly follows that it cannot be a febrifuge. It is surely not intended to be seriously asserted that the whiteness of quinine has anything to do with its virtue as a medicine. The only advantage that might be claimed for the absence of colour in quinine is the difficulty which it might be supposed to offer to adulteration. But this is an imaginary advantage, for few things are more easily adulterated than a white powder, and as a matter of fact much of the substance that is sold in India as Sulphate of Quinine does not contain a single particle of that salt. It has sometimes been brought as an objection to the Sikkim preparation that it is a mixture of three alkaloids. In urging this it is apparently forgotten that it is only of recent years that the various alkaloids of cinchona bark have been separated from each other. The quinine of five and twenty years ago consisted of the sulphates of them all in a crystalline form, just as the Sikkim preparation contains them in a non crystalline form. But it has never been pretended that the "quinine" of our youth was a bit inferior to the quinine of to-day, which consists, or rather ought to consist, of the latter alkaloid only. The efficiency of the Sikkim product can be much more thoroughly tested in this country than in England, where malarious fever hardly occurs. A medical officer in any mofussil dispensary probably sees more cases of fever in one morning than the whole medical profession in England would see in a year. About two tons of cinchona febrifuge have been disposed of in India during the past twelve months and the value of the preparation as a febrifuge rests on the testimony of the highest medical authorities in the country. Moreover, there are chemists and chemists. The greatest authority on quinology is undoubtedly Dr. De Brij, late Quinologist to the Dutch Government in Java. And Dr. De Brij, has given his verdict in favour of the mixed alkaloids produced at the Sikkim plantation. Neither in listening to the opinions of anonymous chemical critics should it be forgotten that there are chemists who are also makers and sellers of quinine. The success of a preparation which is intended to supersede quinine in this country, and which can always be obtainable unadulterated, and at a fixed price much lower than that of quinine, can scarcely be expected to be viewed with equanimity by those whose pecuniary interests are affected. The silversmiths of Ephesus were not backward in abusing the innovation which threatened to put their craft in danger. There is probably quite as much human nature in manufacturing chemists as in silversmiths, and human nature does not appear to have changed much since Diana was worshipped in that ancient city.

THE GOVERNMENT CINCHONA PLANTATION IN BRITISH SIKKIM.

REPORT FOR THE YEAR 1876-77.

FROM the Government Resolution on these cinchona plantations, we see that the year 1876-77 has been a very busy and successful one. The crop of the year consisted of 201,455lbs. of dry red bark, and 6,326lbs. of yellow and pale bark, or 207,781lbs. in all This, though a little short of the outturn of the preceding year (211,931lbs.), is largely in excess of the amount (150,000lbs.) estimated by the Government of India in their letter No. 208, dated 21st June 1873, as the probable yield of the plantation in 1877. Moreover, while in 1875 76 no addition was made to the permanent plantation, in the year of report, 110 acres of new land were planted with red bark trees, and 105,000 red barks were planted to replace in equal number uprooted in taking the bark crop. The nurseries were also replenished with young stock, and the roads, bridges, and buildings of the gardens were put into good order.

Special attention continues to be paid to the three methods of harvesting, namely thinning, uprooting, and coppicing. The total amount of bark obtained by thinning was 57,365lbs.; by uprooting, 129,711lbs.; and by coppicing, 12,108lbs. Thinning is an operation intended rather to benefit the trees left behind than to secure a crop. The respective merits of uprooting and coppicing, to which allusion was made in the previous year's report, are yet undecided. Some years must pass before an opinion can be formed (1) as to how young trees will thrive when planted on land cleared by uprootal, and (2) as to the quality and quantity of bark that can be collected from the shoots of coppice stools. The experience of the year has, however, proved that partial coppicing is a failure, as the young shoots are then thin and sickly, and suffer from the shade of the overhanging trees. No further trial will be made of the Nilghiri plan of cropping by the process of renewing the bark under moss. It is found quite unsuited to Sikkim.

During the year 406,600 plants of red bark *(cinchona succirubra)* were planted out, namely 237,400 (equal to about 87 acres) on the new or Sittong division, and 169,200 on the old or Mungpoo division. As many as 105,000 trees were uprooted in taking the crop, so that the actual increase of trees in the Mungpoo division was only 64,200. This brought up the total number of red bark plants on the permanent plantation to 2,691,600. Besides this, there were on the 31st March last 470,000 seedlings, which can be planted out during the current season. The experiment of propagating the yellow bark (*cinchona calisaya*) has not, during the year, been attended with much success. The number in the permanent plantation remains unaltered, but the number of stock plants has been double, and Dr. King hopes that the experiment during the current year will be more successful than heretofore. The experiment of growing crown bark (*C. officinalis*) has also not been successful, but the new variety (as yet unnamed) promises to do well.

As noticed above, the crop of the year amounted to 207,781lbs., and the stock on 31st March 1876 was 161,290lbs., making a total of 369,071lbs. Out of this, 190,798lbs. were made over to the Quinologist during 1876-77, leaving in hand 178,273lbs. on the 31st March 1877. The net cost of the bark produced is calculated at 3 annas 9 8 pies per pound, or 3 8 pies in excess of the estimated cost (3½ annas). But the actual cost is not quite six pence per pound, while the price of South American bark in the London market has lately been from six to ten shillings per pound. Dr. King thinks that the plantation is capable of yielding a third more bark during 1877-78 than during the year of report, and of course if the plantation is worked up to its full producing power, the prime cost of each pound of the outturn will be proportionately reduced. Mr. Wood is at one with Dr. King in recommending that the full estimated crop of bark should be taken during each year, any quantity beyond the Quinologist's requirements for manufacture being sold in London. The plantations have now developed to such an extent that they can safely be conducted on sound commercial principles; there is no reason why we should refrain from reducing the cost of the plantations by making the most of their regular outturn. The Lieutenant-Governor therefore approves of Dr. King's proposal to collect at least 300,000lbs of dry bark during the year.

From the Quinologist's report it appears that the actual quantity of bark worked during the year was 190,768 instead of 240,000lbs, which was the original estimate, as the manufacture had to be suspended for two months in the beginning of the year owing to the non-arrival of soda from England. This, and the increased cost of the bark, as noticed above, raised the cost of the febrifuge. The total quantity of febrifuge produced during the year was 3,750lbs., and its aggregate cost amounted to Rs. 60,747-13-1, or Rs. 16-3-1⅝ per pound, *i.e.* 3 annas 1⅝ pies in excess of the estimated cost.

The total amount of the febrifuge manufactured by Mr. Wood, including the quantity produced during 1876-77, has been 5,739lbs. 12oz., and it has been thus distributed, viz. :—

	lbs.	oz.
To Medical Store Department	1 942	14
Sample distributed	31	12
Sold by Dr. King	45	0
In Store on 31st March 1877	3,720	2
TOTAL	5,739	12

Dr. King has since reported that up to 31st August last 1,845lbs. were disposed of, namely 1,011lbs. were supplied to the Medical Department on indent, and 834lbs. were sold to the public, and he hopes that the remaining quantity now in stock, together with whatever Mr. Wood may be able to manufacture, will be all disposed of very shortly.

The cinchona febrifuge, though capable of improvement, has met with high approval from Dr. De Vrij, the leading authority in Holland on cinchona alkaloids : and it is found in practice to be a powerful and efficient remedy for fever of an ordinary type. The question of the best mode of dealing with the bark in order to the production of a purer alkaloid, and the general question whether local manufacture is preferable to disposal of the crop at home, are under reference to a Committee, and no steps will be taken to extend or alter the mode of manufacture until their report is received.

AGRI-HORTICULTURAL SOCIETY OF INDIA.

Monthly General Meeting held, on Thursday, the 21st March 1878.

GARDEN.

The Gardener's monthly report was next submitted, announcing the receipt of certain contributions, including palm seeds from Queensland, which have germinated well. The principal work has been the cleaning up of the garden to a certain extent and preparing beds for recently imported rose plants. The Gardener offers the following remarks in respect to Davidson's " Wheelhoe " There was a trial here one morning of Davidson's " Wheelhoe," an invention for keeping Tea Gardens clear with economy of labour. The ground on which it was tried was very weedy and the instrument did not answer well, as it became clogged with weeds and rubbish ; however sufficient was done to show that it would work on clean ground, and I think it is quite capable of doing all it was invented to do, *viz.*, keeping ground clear by continually moving the surface with little labor, and for light soil it will perform that with little strength to propel it ; but for heavy land it will require more than the strength of one cooly."

FLAX CULTIVATION FOR FIBRE.

The subject which next engaged attention had reference to the following letter from Mr. R. Macallister on cultivation of flax for the preparation of fibre :—

"I submit herewith for the consideration of the Society samples of linseed straw and fibre worked thereform. This flax was grown on the plantation of Mr. Lethbridge, Otter, Tirboot.

"No. 1 Straw is of last season's growth from Belgian seed, a fine long straw without branches ; the average length is three feet. This sample is as fine as any I have ever seen in Europe or America. The sample of fibre marked A is the produce of a portion of the original sample of stalk sent me by Mr Lethbridge. This fibre has only to day, 12 months after growth, been taken from the straw by the rough process of a heavy jute softener ; had the usual machine been available, the sample would have been much better. No. 2 straw of last year's growth also. This sample was grown on the same spot of land from the same seed as No 1. The difference is owing to thin planting, the No. 1 is from thick sowing, whilst No. 2 is from thin sowing. Thin sowing in any country produces branches, straw, more wood in proportion to the fibre, and weak fibre. The fibre of sample B produced from No. 2 stalk, you will observe, is deficient in strength. No. 3 is a sample of this year's straw, grown by Mr. Lethbridge from Belgian seed. This is a well-grown long straw, rich in fibre, of first class quality. This sample has been plucked a little too early and not steeped long enough, as the sample of fibre accompanying (marked C) will testify.

" These samples will be sufficient, I think, to show the Society what is likely to be the result of intelligent working amongst Indigo Planters and other Agriculturists now that there is a local demand for the fibre.

"I have not found time to go into the matter more particularly, but as we are now carrying out pretty extensive experiment, at Deegah, near Dinapore, under professional flax growers, we shall soon be able to lay before the Society more interesting details.

"I enclose for the information of the Society three letters on the subject of flax from persons in our employ, which we think may be interesting as relating to their present experiences."

The letter having been read, Mr. Macallister made several useful remarks regarding the various specimens on the table with reference to the mode of growth adopted and the consequent increase or decrease in strength of the fibre. Several of the members present were favourably impressed with the strength of some of the specimens and its usefulness for local manufacture.

The letters referred to by Mr. Macallister were likewise submitted, of which the following are extracts:—

Mr. A. S. Patten, writing from Dinapore, observes :—

" I was strongly advised by several planters to visit Sutamurhee, as it was the centre of a large linseed-procuring district. I determined to do so, as I had already heard from natives that the seed was grown in small fields. I ordered palkee dâk to take us into Mr. Mac-gregor's factory at Doomrah, and arrived there the following morning. Mr. Macgregor very kindly drove us all round the country. I am of opinion that if the seed had been sown thickly instead of so sparingly, that we should have had very little to complain of, as the stalk of course, was weak owing to several branches growing from the same seed. This has been proved by Mr. Lethbridge, who has produced a stalk quite as long, and nearly as strong, as that grown from Belgian seed. It will be for you to urge the Government to encourage the planters and natives to sow linseed from an imported seed, instead of using the same seed year after year. The natives in Tirhoot appear to have a great opinion of manuring, and it only requires some management from the Government to produce as strong a fibre as in Europe and America, as the heat in the latter is quite as great as in these districts. On Friday evening we returned to Bhicanpore where Mr. Swaine met us, and we drove to his factory at Ottee. We examined the field and found the stalk had been pulled a little too soon. I repeated my offer to set and work off all stalk that he or Mr. Lethbridge would send me at Deegah, and promised to inform them of the result. On arriving at Ottee, we met Mr. Lethbridge, who told me that he had just received a letter from you and would despatch all stalk for me to set and scutch. We then started for the railway station at Mamuri, and arrived at Barr on Sunday afternoon and remained there, as there was no train for Dinapore that night. We returned to head-quarters yesterday morning.

" I am only waiting here, as several natives have promised to bring in a quantity of stalk which I intend retting on the chur opposite the bungalow, as I am very anxious to prove that, although the native stalk is weak, we can still work at a profit by studying economy. I am sure that if you will import seed from Russia, say from Odessa or Taganrog (the ripe seed is from a much colder climate), that we should be able to realise your first ideas as to the profits. I think that it would be a good plan for you to address all the Zemindars in these districts, advising them to advance to their ryots seed purchased or exchanged from other districts, and that by cultivating their ground a little more and sowing more thickly a far better return would be given, and a higher price would be paid for the stalk.

" You must not forget that this year has been a particularly unfavorable one for growing linseed owing to the want of rain.

" Several planters have promised to send linseed, so that I have great hopes, our visit will not be without a good result, and that you will have a large supply of lint next year from this district."

Mr. Crawley, writing from Dinapore, remarks :—

" Mr. Patten showed me your letter, asking me for my opinion about the prospects of the flax

" We have visited a great many places since I came here, one place 'Sima,' about ten miles from Arrah, close to the Ganges, appeared to me to produce a much better flax than any we had previously seen. I examined several samples . the straw is a good length, fully as long as the green sample I saw in your office, the fibre is much stronger and has not that tendency to snap and tear short off the wood like most of the other samples. There is every facility for retting close by. I consider, with proper care and close attention, the flax could be worked in this district with considerable success. With regard to Tirhoot, Mr. Patten and myself have just returned from a four days' run in it. I examined several specimens, but I did not like them. We called with Mr. Lethbridge, and here I found a change which confirms my opinion expressed to you, that flax grown in the manner in which the ryots grow it, will not answer ; but that indigo planters and such like, who have capital and can afford to sow it in rich soil, that is well-cultivated and well-cleaned, may grow it successfully. Mr. Lethbridge had a small field of flax sown with native seed in rich soil that was cultivated well cleared of all weeds, and appeared to have been carefully attended to ; he was just after pulling it. It is almost as long as the sample of Belgium flax which he sent you, stronger and much superior in every way to any native grown flax that I have seen. I thought it a pity to let him have the working of it, as he knows nothing about it, so he is sending it, and his Belgium flax, down here, where we will steep it and work it out.

" In about ten days we will be able to have it scutched, but I have not the smallest doubt as to the result being highly satisfactory.

" There are two other places, where we intend steeping some, but before giving my opinion, I would prefer waiting till I see a parcel of the flax steeped and dried, when I will see how the fibre behaves. If it will scutch and cast the wood any way freely, I don't think you can loose anything in working a large parcel of it. It will, however, require economy and close supervision to leave a margin for profits."

The best thanks of the meeting were tendered to Mr. Macalliste for his communication, for the inspection of the various specimens and for his promise of further details in due course.

In connection with the above, the Secretary referred to the great interest the Society had always taken in flax culture, for the sake of its fibre, as evidenced in the numerous communications and reports which it had from time to time brought to the notice of the public during the past thirty six years, through the medium of its journals and proceedings, commencing in 1840, when experimental cultivation was begun by a Member of the Society, Mr. Rogers, in the Burdwan district, and carried on for some time very perseveringly and at considerable expense. Then again, by another member, Mr. Leyburn, in the Shahabad district ; by Mr. Wallace at Monghyr ; and subsequently, several years afterwards, by Mr. Cope in the Punjab. These, and various other experiments made at intervals, and published by the Society, are fully quoted in a report in 1873 to the Government of Bengal by Mr. W. H. D'Olly, C S. None of these numerous experiments resulted successfully in a commercial point of view, though the produce was, in many instances, favourably reported on, as it could not apparently compete in the home market with the produce of Europe. Flax, for fibre, cannot, it is feared, be profitably grown in Lower Bengal; now, however, that a local demand has arisen for it, and the attention of indigo planters and others has been attracted to its cultivation and preparation, there is a fair prospect of success attending the renewed endeavours that are being made for the growth, for its fibre, in Upper Bengal, of this useful and valuable product.

Introduction of Silk Worm Eggs from Japan.

The Secretary, in submitting the following letter from Mr. G. DeCrestoforis of Jesgunge, stated that the subject had been brought to the notice of the Society some years ago, and several communications connected therewith published in the journal. The Society had obtained a quantity of eggs for distribution, but the result was not successful, probably from the causes alluded to by Mr. DeCrestoforis.

"Aware of the interest which the subject of this letter may find with your Society, I think no better channel is offered to me than addressing you in order to obtain publicity and support to my proposition.

"It is well-known how the cocoon crops of Bengal have since many years fallen off very considerably in quantity and quality, whether from the deterioration of the breed, from diseases or other causes. My motion is that an experiment should be made of rearing in this country the annual silk worm of Japan, which gives a far superior produce than any of the Bengalee species. Experiments of the Japanese breed have already been made many years ago in this country, but without success, and the reasons of this failure may be traced to many causes.

"The first and the most important is that silk-worm eggs of the annual species should go through a winter season before they can obtain maturity, and hatch properly. This was never done with the eggs that were years ago distributed in Bengal.

"There is also no certainty that such silk-worm eggs, as were sent at the time, were annual or bivoltine. Beside this, as far as I can remember, the Japan eggs were distributed too late in the season when the hot winds had already set in.

"As I have for the last five years gone out to Japan to buy silk worm eggs for my constituents in Italy, and am now soon going back to Yokohama for the same motive, I would propose that a subscription for importing annual Japan cards in India should be opened here, and I would undertake to buy them and forward them so as to be out here on about the end of November next.

"The cards on arrival here should be sent at once to the North, where they might be kept two months or more at a regular temperature of about 20 to 25 degrees of Fahrenheit, beginning, if possible, at 35 degrees, and gradually lowering for the first ten days; and afterwards brought down in Bengal for distribution amongst the natives, the cocoon rearers of the different silk districts.

"In my opinion the best time for hatching them would be on or about the end of February. From the produce, experiments may be made to improve the Bengal species by cross-breeding them with Japanese, or fresh importations of eggs from Japan may easily be procured every year. The cost of a card delivered here would average from 3 to 6 rupees, and a card can produce close to a maund of cocoon, which, for their superior quality, would be worth double the price of the Bengal cocoon, taking also into consideration the better class of silk that can be obtained.

"If this proposition will meet the favor of the Government of India on behalf of the impossible native cocoon rearers, and the favor of the silk manufacturers of Bengal, particularly if your Society will second my views, and give publicity to them, I doubt not that a great change for the better will be obtained for the sericulture of this country.

"If requested, I shall be glad to give any further particulars as regard the terms on which I propose that the business should be carried on."

Proposed Extended Utilization of the Singhara Nut.

Some further interesting particulars on the above important subject were submitted by Captain J. F. Pogson, in continuation of those which were laid before the general Meeting in December last :—

I send, writes Capt. Pogson, for utilization and publication in the Society's proceedings, a second paper on Singhara cultivation [from the *Delhi Gazette.*] The sound, simple, and practical measures suggested by me may or may not be adopted.

"But as the Indian Authorities may, under pressure from England, have to expend several millions sterling on water-works, and to store water for use when the rains fail, the information I am about to give might be utilized, and so prevent the State from suffering considerable pecuniary loss during those years, when the rains are regular and plentiful, and the ryot and zemindar declines to use canal or lake water for his crops.

"The Chinese are a rice-eating nation. But being well instructed in agricultural matters, they extensively cultivate the "*Ling*" (Chinese for the *Tripa bicornis*), which with them forms an important article of food, and has done so from time immemorial.

"It is highly probable that the first food-producing plant, cultivated by man after the Deluge, and before the soil had been sufficiently sweetened to grow rice, wheat, and other cereals, was the *Trapa natans*. That it was cultivated in Europe in ancient times will be admitted when it is known, that 'They have been recently discovered in a very perfect state of preservation amongst many other vegetable products in the ancient lake habitations of Switzerland."

"Pliny, who wrote on the subject some eighteen hundred years ago, states 'that the Thracians made bread of them,' and as the modern inhabitants of many districts in Southern Europe to this day convert the kernels of the dried nuts (*Trapa natans*) into meal, and with it, after suitable manipulation, 'make and bake very good bread' the value of the *Marron d'eau*, or water chestnuts of France, and the 'Jesuit' nuts, of Venice, may be considered as fully and fairly established. The Chinese species (*Trapa bicornsi*) is provided with two horns, whilst the far superior Indian species, *Trapa bispinosa* is provided with two formidable thorns, which protect its large kernels from being devoured by wild animals.

"Mr. John E Jackson in his paper '*Curious Forms of Fruits*' states in reference to the water-nuts, that 'All the species are floating water plants; they have long, jointed root stocks, and the roots themselves are very fine and hair-like. The leaves are triangular, dentate or toothed, and are arranged in a cluster, while the stalks are buoyant, and help to float the leaves. *Tpara Natans* is a native of the South of Europe, and grows in stagnant or slow running waters'. The *Singhara* of Indian flourishes in the lakes of Cashmeer, and also in ordinary tanks all over the upper Provinces and Bengal. The owners of tanks, under 'Singhara' culture, derive a very handsome annual income from their property, and to prevent the extension of this profitable cultivation they have caused European inquirers to believe that the shortest way to fill up an extant tank (irrespective of its size and depth of water), is to plant with water nuts. The *Indian Traveller*, quoted by Mr. Jackson as an authority, states, 'The people are very fond of these nuts. They ripen in the latter end of the rains or in September, and are eatable till the end of November. But the mud increases so rapidly from this cultivation, that it soon destroys all reservoirs in which it is permitted and when it is thought desirable to keep up the tank for the sake of the water it should be carefully prohibited. It (Singhara) is cultivated by a class of men called Dheemurs, who are every where fishermen, and palankeen bearers, and they keep boats for the planting, weeding, and gathering of the Singhara.' The absurdity of an aquatic plant with fine hair-like roots, inducing the production of mud, is apparent, and the fiction is at once knocked on the head, by the fact of boats and 'ghurrah' floats being used to carry on the cultivation in the same locality from year to year.

"The jheels and tanks, in which the Singhara is grown, almost as a rule, contain some sort of fish, and these are netted either by the lessees for their own benefit, or else for that of the proprietor, who remunerates them for their labour.

"The palkee-bearers of Bengal Proper, Oudh, N.-W.-Provinces, and other parts of the country, are not only agriculturists, but load-carriers. The *banghy* of the *kahar* requires no explanation. With it he carries the traveller's pittaras, or when occasion requires, cowdung cake fuel, mangoes, fish and Singharas. He is a proficient in the art of making net-work, of twine, stout string or half inch rope. If fish are to be had in his neighborhood for the catching, a cotton string net, with mesh of suitable size, is soon forthcoming, and he increases his income by catching and selling the fish. The genuine fisherman by caste and hereditary avocation is called a *mutchwa*, a term never applied to the *kahar*, who, when enlisted, makes a brave and gallant sepoy, and when utilised as a camp-follower, carries hospital doolees under fire, and the sick to hospital in cantonments. Of all the castes of Hindoos, the *kahar* is the most useful and easily managed. He will serve in any part of Hindoostan, and, if the project of systematic Singhara cultivation is carried out, the employment of *kahar* as workmen and practical instructors will have to be adopted.

"The great difficulty the Government of India has to contend with is not so much famine as, the habits and customs of the population. In Bengal Proper and Madras, the people live upon boiled rice, and decline to use leavend or unleavend maize, millet, or wheat bread. In the Punjab rice from Bengal would be of little use in relieving a famine, for without wheat and millet bread as a stand by, the stalwart Punjabee would lose flesh and muscle and suffer from innutrition. In the Himalayas maize meal bread is the daily food of the labouring and agricultural classes, boiled rice with sugar and *ghee* or *dal* is for high days and feasts of honour, and for not hard hill work which the rice-eating Bengallie could no more undertake than a Thibetian goat could carry the load of a mule. The good folks of England have been greatly puzzled at India exporting immense quantities of wheat *via* the Suez Canal, whilst a famine was raging in the Presidency of Madras, and they would no doubt be quite bewildered, if Bengal and Madras sent shiploads of rice to the United Kingdom, during the prevalence of a famine in the North-Western Provinces and Oudh.

"The explanation given is intended to convey to the mind of the British public that their is always an ample supply of food-grains in Hindoostan. But that if millions will starve rather than eat bread, and others languish if placed on rice, the consequences rest not on the Government, but the people.

"That India will suffer from future famines is more than probable. I venture to submit that with the exception of the *Singhara*, there is no other food-crop available to meet our wants.

"The rice-eating millions of Bengal and Madras will eat these tasty and nutritious nuts with pleasure if they be avialable, and the bread-eating millions will do the same. The beds and bottoms of lakes, jheels island fresh water seas, and *vast reservoirs* yet to be made have only to be planted or sown with the matured nuts, to bear immense crops on the water's surface, and as the harvest or season lasts for three months, starvation from famine ceases to be a menace; finally, as the dried nuts will keep good for years, and may be easily stored, the maximum of surplus and extra wholesome food is secured at the minimum of cost."

In a subsequent letter of 31st March, Captain Pogson adds as follows :—

"Your kind letter of the 9th instant reached me yesterday, and I am very glad to learn therefrom, that the further information on Singhara culture is considered of use and value. [This refers to an application from the Editor of the Provincial Gazetteer, N.-W.-P., for a copy of Captain Pogson's previous paper.]

I only hope that in place of paper war and work ending in nothing, the Government of India will look upon Singhara cultivation as an Imperial measure, directly connected with Finance, and Prevention of Famine, and act accordingly.

"If the present season for sowing the nuts is allowed to pass without the formation of nursery plantations, not only will a year be lost, but a tidy round sum of money will have to be paid for seed-nuts to be purchased from the zemindars in 1879.

"I hope my language has been sufficiently clear, to make the obstructive reader understand, that every square mile of water surface, if covered with Singharas, represents 640 acres of food-producing area, which will yield saleable produce for three months, and in no way interfere with irrigation, should the ryot, under pressure of drought, decide on using the water accumulated at great cost for his benefit.

"If this was well and widely known, the Madras Revenue Authorities might soon become converts to our views, and the introduction of the water-nut would follow. The Government must make up its mind to bear the cost of producing additional revenue without resorting to taxation, and the water-nut project properly carried out will very soon get them (Government) out of financial difficulties.

We should bear in mind that the sun-dried nuts, (kernel) if put up in sacks and sent to Europe, would meet with immediate and remunerative sale, and as they will keep in their tough outerskins for years, all we have to do is to find out some chemical solution which, when absorbed by the skin, will prevent white-ants and rats and mice from attacking them. When this is accomplished, the nuts may be kept in pits for years. I will in due course go into this matter, and report progress for publication.

"I am greatly obliged for your offer of vegetable seeds, all you can spare will be very acceptable. American maize is of great value; and through my good friends the Missionaries, even the people of 'Lahoul' in Little Thibet will this year see for the first time cobs of maize, the produce of seeds received from you, acclimatized by me, and then given to the Missionaries. In like manner, beans have been distributed, and at Kotegurh, the Slyhet bean first sent you by Mr Hudson, and on to me, grows most vigorously and yields abundantly.

"If available, I should like to have one seer of 'Reana luxurians' seed, as it will be "a boon to the hill men. Yesterday dry hill grass was selling at fourteen annas a maund! ! !'

HORTICULTURAL NOTES.

In his letter of advice of despatch of the collection of acclimatized flower seeds previously referred to, Mr. H. E. Abbott of Jaintpore, Tirhoot, writes: "These are all I can send you this year worth having, though later on I shall have some very fine Portulaca seed for you. My balsams this year were not fine the want of rain affecting them much, and I shall be glad to obtain a fresh lot from you. The seeds sent last year by the Society afforded me great satisfaction, scarcely anything failing. Messrs. Buist's collections (American) are always good. Vilmorin Andrieux (French) are generally to be depended on.

"My Sweeds and Mangal Worzel, although very fine, do not come up to last year, for two reasons.—first the deficiency of rain, and secondly that during my absence in Calcutta, my clever jamadar sowed them in exactly the same field as that of last year. Hence as is but natural, they are not equal in size to the monster specimens of last year; still the success is undoubted, and I hope the Government will be induced to import a quantity of seed and offer it to the ryot at reduced rates; its chief advantage being the root being procurable at a time of year where there is little or no other green food available for the cattle."

A. H. BLECHYNDEN,
SECRETARY.

AGRI-HORTICULTURAL SOCIETY OF MADRAS.

Meeting of Wednesday, the 9th January 1878.

READ letter from F. D. Ditmas, Esq., Honorary Secretary, Planters' Association of North Wynaad, dated Manantoddy, 11th December 1877, intimating that all the Liberian coffee plants sent to their Association had died, and forwarding a copy of their Proceedings on the subject.

Read also Minutes of Committee Meeting of the Planters' Association of North Wynaad, held at Manantoddy, 24th October 1877, containing a resolution that the Society be thanked for the Liberian coffee plants sent to the Association.

Resolved that the Secretary's letter and Minutes be recorded.

Read Memorandum signed by Dr. Cornish, Sanitary Commissioner, 101, Madras, attached to a revised list of wild plants and vegetables used as food by the people in famine-times, prepared by Dr. Shortt.

Resolved that this list and that prepared by Mr. Yarde, at the request of this Society, and published at page 151 ante, be sent to Dr. Bidie, who has, the Committee understand, the matter in hand, with a request that he will favour them with the result of his inquiries for publication in the proceedings of this Society.

Read letter from L. A. Bernays, Esq., Vice-President, Queensland Acclimatisation Society, dated Brisbane, 19th November 1877, acknowledging Mr. Shaw's letter of 18th September last, and stating that the case of Cycads referred to as despatched on the 8th idem had not arrived; that our case of orchids has been quite successful, all growing without exception; that their promise of Queensland Cycads is not forgotten, but owing to the dryness of the ground it will be the turn of the year before they are despatched; that he observes from the papers that this Society is interesting itself in Eucalyptus, so sends a small quantity of the seeds of *E. rostrata* and *E. amygdalina*, taking the opportunity to add the following seeds, which they happened to have just received:—*E. globulus*, *Petalostigma quadriloculare* (*var. glabrescens*, found very useful as a substitute for quinine by infusion of the bark), *Terminalia melanocarpa*, *Bignonia sp.*, and in another bag packed in seed of a very useful grass (*Sporobolus elongatus*), *Banksia latifolia*, and *Elæocarpus grandis*; that on the 9th November he sent us *viâ* Torres Straits a tin of seeds of their handsome palm, *Ptycosperma Alexandræ*, and a bag of *Elæocarpus grandis*, and hopes that of the lot some may be acceptable; that as a guide to their wants he encloses a list of seeds of which this Society will be glad, those most desired being therein marked in red; and that they beg this Society to express freely its requirements, as it will give them great pleasure to do their utmost to meet them in any way.

Resolved that the Queensland Society be thanked for the liberal supply of seeds sent and their promise of further favours, and that they be assured that every effort will be made to meet their requirements.

Resolved that the seeds be distributed as usual, and that in sending some of the grass seed to Mr. Robertson, the Superintendent of Government Farms, he be asked to favour the Committee with the result of experiments with the supply sent to him in 14th July last.

Read letter from the Superintendent, Royal Botanical Gardens, Howrah, dated 19th December 1877, stating in reply to this Society's request for seeds or plants of *Deana luxurians*, made in consequence of the letter from Mr. Gaitskill, and resolution thereon published in the proceedings of 7th November last, page 188 ante, that he regrets there is no seed in stock, but that our request will be borne in mind.

Resolved that the above be communicated to Mr. Gaitskill.

Meeting of Wednesday, the 6th February 1878.

Read letter from Dr. Scheffer, Director of the Botanic Gardens, Buitenzorg, Java, dated 13th December 1877, stating, in answer to the Honorary Secretary's letter of 31st October last, that he sends report of his gardens for 1876, from which it will be seen that the plant formerly received from the Mauritius under the name of *Heavea elastica* is really a species of Manihot that produces no India rubber; that there is no other species of Hevea in their gardens, and that he sends some seeds; and in answer to the Honorary Secretary's letter of 6th November last, that he is sorry that he cannot assist us to obtain cinchona seed, but suggests an application to T. C. Bernelot Moens, Bandon, Java, the Director of Cinchona Plantations.

Resolved that Dr. Scheffer be thanked for his letter, the trouble he has taken, and the information he has afforded; and that an extract from Dr. Scheffer's letter, with some of the Manihot seed, be forwarded to Major Wood, R.E., Walter, in further reply to his letter of 25th September last (*vide* page 180 *ante*).

Read letter from L. A. Bernays, Esq., dated Brisbane, 1st December 1877, thanking this Society in very courteous terms for the box of roots of *Cycas revoluta* and *Circinalis*, which had arrived, with inconsiderable exceptions, in very good condition; and stating that the Council of the Queensland Acclimatisation Society hopes that by making known our requirements we will give them an opportunity to reciprocate, and that promises already made will not be forgotten.

Resolved that Mr. Bernays be thanked for his courtesy, and that efforts be made to keep up a steady interchange with this Society.

Read the following letter from Major Sherman, dated British Consulate, Pondicherry, 11th January 1878:—

"I am delighted to inform you that the Liberian coffee plants you sent me six months ago are flourishing well. All six are doing well in the open and throwing out new leaves and shoots. They are now under two feet in height, and growing fast and looking healthy. I found so long as they were kept in pots they did not grow, but the moment I planted them out in the open, protected from the N. E. winds, I was surprised at their growth. They began to throw out leaves, and the late rains have done them a world of good. I planted them out into light but richly manured soil; the manure consisted of equal parts of leaf mould, pig manure, and sweepings of my poultry yard. I had the pits made three feet square and four feet deep. Into these pits I laid first of all a good layer of pig manure, then the sweepings of my poultry yard, and on the top of that rich red soil from the Grand Etang, which is light, and mixed with the leaf soil manure. The plants received the water from my bath tub at first, but since the rains they have been irrigated from the well. Many persons have been to see the plants, and are astonished at their fine condition. I am sure the soil about here (Ariancoopum) is just the soil for the Liberian coffee tree. I would advice Government sendig some plants to the Collector of Cuddalore for trial and report. I would be delighted to render him every assistance in the experiment. If you could spare me six more plants I would be obliged, also some chincona seeds from Java trees. I would also like to try the nutmeg plant and the cocoa plant, and if you could supply me with half dozen of each I should be grateful.

"I planted my coffee plants out, because I discovered that their roots were being injured by so close a confinement, and the plants would not grow. Dr. E. Eyre Lloyd, of Tanjore, should be advised to transplant his coffee trees out in large pots first, sheltered from the N. E. winds, keep them in these pots for one month, and then plant out in the manner I have done. I am sure he will find that they will grow fast, but the final planting out should be made when the rains set in. I am quite delighted with my success."

Resolved that Major Sherman be thanked for his very interesting communication, and informed that this Society will be grateful to him for further reports of the progress of his plants.

Read letter from R. Woolley, Esq., dated 13th January 1878, stating that as he is about to leave Madras he wishes his membership of the Society to cease from the end of 1877; that the three Liberian coffee plants given to him are thriving; that he proposes to try them at Kotagherry on land at an elevation of about 3,500 feet, where the soil is rich and situated in a valley very often full of mist, and that he will be glad to be of use to this Society at Coonoor.

Resolved that Mr. Woolley be thanked for his letter, and informed that this Society will be glad to receive an occasional report on the progress of the Liberian coffee plants.

Read letter from P. Hunter Blair, Esq., dated Peermaad, 1st January 1878, asking for seeds of Bahmie cotton; letter from J. Cameron, Esq., to whom application was made for seed; notices in the *Gardeners' Chronicle* of 5th May and 5th January last; and interesting extracts from the *Indian Agriculturist* of 1st November last, and *Rangoon Daily News*, kindly made and forwarded by Mr. Cameron.

Resolved that efforts be made to obtain seed of Bahmie cotton, and that Mr. Robertson be communicated with on the subject.

Read Proceedings of the Board of Revenue, No. 5171, dated 6th December 1877, reviewing the reports of Collectors on the cultivation of Manila Hemp in their districts, and requesting the Collector of Malabar and Superintendent of Government Farms to report regarding the proposition of the Government of India as to the introduction of machinery for extracting the fibre.

Resolved that these Proceedings be recorded.

Read letter from F. E. Harman, Esq., dated Experimental Farm Office, Bangalore, 22nd January 1878, stating that he has been directed by the Government of Mysore to cultivate the Giant Russian Sunflower for the purpose of testing its adaptability to the agricultura conditions met with on the experimental farm; that from papers placed at his disposal he believes that this plant is cultivated by the servants of the Alta Italia Railway Company in Hungary and in South Russia, and that he will esteem it a favour if this Society will assist him to procure the necessary seed from some reliable source.

Resolved that every effort be made to assist Mr. Harman in his interesting experiment.

ADVERTISEMENTS.

IMPERIAL INDIAN TEA MANURE.

THIS Manure is especially manufactured for the growth of the Tea Plant in India. The object is to supply back again in the same rates to the soil those elements which the plant extracts from it, and, at the same time, having due regard to the proper balancing of the constituents, so that the stimulating properties shall not be in excess of its fertilizing quantities as is the case with Peruvian Guano, Nitrate Soda, Sulphate of Ammonia, and many patent and artificial manures that are sold without the slightest regard to the duties they have to perform. Most of the above manures, although found to stimulate the plant producing luxuriant growth, do not supply some of the most important elements of nutrition, but mere vegetable growth, at the same time exhausting the soil by returning to it only its Nitrogen, leaving the Phosphates, Potash, and other elements to be extracted annually by the plant, and in course of time the land becomes barren and sterile. The result is now developing itself in many places, more especially on the sugarcane lands.

THE IMPERIAL INDIAN TEA MANURE

is manufactured expressly for the above crops. It contains sufficient Ammonia in the form of fixed salts to stimulate vegetation as far as it is desirable, and being in that form will not be evaporated by heat, but will attract the moisture from the night dews, and supply the plant during the day.

It is rich in Phosphates in the most available form, as also Potash, Magnesia, &c., and other necessary ingredients, each in the correct proportion for Tea Plant nutrition. Its action is, therefore, one of equal and regular feeding, and plants grown from it are developed in all their functions in healthy proportions. No irregular and weak expansion of foliage is created at the expense of vital sap or the ripening and maturity of the plant out of due season.

Having had twenty years' experience in the manufacture of manures exclusively for the wholesale market, we are able to produce a manure manufactured on the most scientific principles, and one that will hold its sway when many others have become things of the past.

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FOR SALE.

A TEA estate of 77 acres, 30 of which have been planted for some years situated just outside Municipal limits of Ootacamund, Neilgherries. Apply to

MAJOR-GENERAL BAKER,
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COVERS nearly double the space of any other Zinc or Lead paint. Is perfectly snow-white. Does not get discoloured by sulphuretted hydrogen or other noxious gases. Messrs. Lutzchaunig & Co., Assayers to Her Majesty's Government, England, say :—"There is no doubt it will entirely supersede the White Lead."

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Sole Agents.

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RANEEGUNGE FIRE BRICKS as supplied to Government and th various Railways, Iron Works, Coal, Gas and Steam Navigatio Companies. Price Rs. 9 per 100.

Extract from Official Report of tests made at H. M. Calcutta b THEODORE W. H. HUGHES, Esq., F.G.S., A.R.S.M., Officiating Deput Superintendent, Geological Survey, India.

*"The Fire Bricks tested by me were furnished by the Firm of Messr BURN & Co. * * * The materials from which they are made are re refractory and capable of resisting high temperature without sensibl fusing. * * * That compared with Stourbridge Fire Bricks a somewhat superior."*

The specimens were subjected to a temperature of over 3,000 degs. Farh., the smelting point of Cast-iron being 2,786 degs. Farh.

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(Opposite the New Telegraph Office and the Currency Department.)

Importers of every description of Oilman's Stores, Cigars, Tobacco, and Miscellaneous Goods :—

Fresh Invoices

Per S.S. *Poonah* of new American preserves, including

Lunch Tongue	... ...	Re.	1	4	per tin.
Devilled Ham	... ...	„	0	12	„
„ Turkey	... ...	„	0	12	„
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Spiced Salmon	... (a great delicacy) ...	„	2	8	„
String Beans	... superior to French ...	„	0	12	„
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American Ox Tongue, large	... ...	„	4	0	„
„ „ small	... ...	„	3	0	„
Canadian Hams in small sizes	... ...	„	0	14	per lb.

Whitehead's Solidified Soup Squares.

Each square containing the concentrated essence of 1½ lb. Beef, free from fat or bone, with sufficient vegetables and flavouring ingredients to make 1½ pts. of strong nutritious Soup, most convenient for travelling.

Assorted kinds per single square As. 10, or per box of 12 squares Rs. 7.

PRIME BACON IN CUT, AT RE. 1 PER lb.

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Scriptural Text Cards, Toy Books, Albums, and Stationery of all kinds, Walking Sticks, Courier Bags, Gladstone Travelling Bags, Japanned Tin Cheroot Boxes, Dispatch Boxes, Travelling Trunks, Portmanteaux, Hand Bags, Rug Straps, Hat Boxes, Railway Rug, Scotch Mauds, Cuba Down Quilts, Elder Down Tea Cosies,

ALL MARKED AT EXCEPTIONALLY LOW RATES AND THE QUALITY GUARANTEED.

Terms—Strictly Cash.

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STATIONERS AND GENERAL DEALERS,
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Requisites for Hot Season.

BEZIQUE, in Paper Box, for two players, at Re. 1-4; do. for four players, at Rs 2 12, in cloth covered box for two players, at Rs. 2 4, do. for four players, at Rs 4 8; do. superior quality for four players, at Rs 7 8; in grained Morocco box, gilt lined, fitted with Spring Hook for two players, at Rs. 6 8: do fitted with lock and key for four players, at Rs. 12 cash. SPARE BEZIQUE Cards, at Rs. 1 per packet, and cloth covered SPARE MARKERS at 8 as. and do. paper at 4 As CASH. CRIBBAGE, complete with one pack of Cards, book of Rules and patent self-scoring Markers at Re. 1 12 cash

CRIBBAGE BOARD, Wood, at Rs. 3-4 cash.

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CHESS MEN, in Mahogany box, 2 Bone at Rs. 10; do. 3 Bone, at Rs 12 8: Staunton pattern wood large, at Rs. 13-8, middle at Rs. 9 8, and small at Rs 7 cash per box.

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PLAYING CARDS of De La Rue and Goodall and Son's make, First and second qualities both plain and gold back; choicest pattern, from Re. 1-4 to Rs. 2 4 cash, per pack.

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C. AND BROTHERS beg to announce to their patrons and the public at large that they having been appointed Agents by a certain respectable manufacturing House of Trichinopoly, are now prepared to offer for sale the following :—

Real Trichinopoly Cigars

At the following reduced rates :—

Roger's Manilla"	... ...	@ Rs.	1	4	per 100.
Thomson"	... ...	„ „	1	12	„
"Dawson"			1	8	„

"Dudgul," "Havanah," and "Noble" all sold; a fresh supply of them expected shortly.

C. and Brothers take this opportunity to announce also that they are now registering orders for PERFUMERY from Price, Rowland, &c., a shipment of which is shortly expected; qualities guaranteed.

CHUNDER AND BROTHERS,
RADHA BAZAAR, CALCUTTA.

JEBENS' PATENT

Swift and Sure Transplanting Tools.

PROSPECTUSES NOW READY, AND MAY BE HAD ON APPLICATION TO THE MANUFACTURERS.

T. E. THOMSON & CO.,

9, ESPLANADE ROW, CALCUTTA.

SOME of the advantages of these tools are the security, that with very ordinary care, no injury can be done to plants and roots, and the swiftness, simplicity and cheapness of working. The growth of the plant is not at all arrested in transplanting; it grows as if it had not been shifted. Transplanting can be done at all times with little regard to weather. No vacancies or weakly trees from injured roots. The greatest care has been taken to strengthen all working parts. Specially devised to be put into the hands of the coolie.

Mr. J. W. Mountjoy of Pandawbrang, Arracan, writes as follows regarding these tools:

"The Transplanter has in working proved to be a complete success. Almost all the remaining seedlings have been transplanted by the aid of your instrument, without the slightest injury to their roots or check to their growth. The fact is, the young plants do not know that they have been transplanted, and now that sunshine has succeeded the late very heavy rains, new and vigorous growth is "bursting out" from all the seedlings that were transplanted by means of your Transplanter. No Manager of a Tea or Coffee plantation, who had once seen this instrument at work, would ever again be likely to recur to transplanting by hand, and not a single seedling should die when removed from the nursery and carried to its place of ultimate growth by means of your Transporter. Your Transplanting Apparatus is better than baskets, and has moreover the great recommendation of being very economical. Your Transplanter will, with moderate care, last for many years and combines thorough economy with thorough efficiency."

ORDERS are now being booked and will be executed in succession as received by the Manufacturers and Agents to the Patentee, T. E. THOMSON & CO., 9, ESPLANADE ROW, CALCUTTA, to whom orders should be sent accompanied by CASH or Draft on Calcutta Agent.

Nursery Transplanters complete with one Transporter	... NET CASH	Rs. 16
Extra Transporters (1st quality) each	"	Re. 1

The Transplanters are all marked on the cylinder.

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GAS AND WATER CONTRACTORS AND ENGINEERS,

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11 feet 6 inches by 4 feet 6 inches.

AS good as new, only recently supplied by MESSRS. BURN & Co., and has hardly ever been used. Also a Donkey Pump, complete with petcock. A new cast iron 2 inch Safety Valve, complete, and sundry new taps and piping, 1 Drum 48 inches diameter 14 inches broad. Apply to

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TO TEA, COFFEE, AND CHINCHONA PLANTERS.

Attention is invited to the lately-patented

"Wheel Hoe"

AN implement which, for purposes of light Cultivation, is specially adapted for use by manual labour; whilst for deeper Cultivation other draught power may be applied. When used for light cultivation, the Implement when worked by

One Coolie

Is capable of hoeing

One acre per day,

thus effecting a saving of fully 90 per cent. of the labour usually required for such work when done by the ordinary hoe.

Prospectuses and full particulars can be obtained on application to the undersigned, who are prepared to register orders, a consignment of the implements being expected early in March.

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Are manufactured at our London Workshops, and thoroughly tested in every stage of progress.

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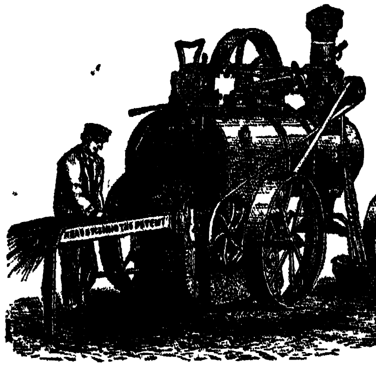

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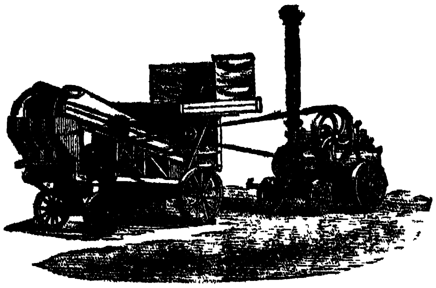

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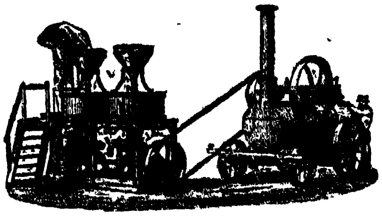
fitted with patent apparatus for chopping and bruising the straw for food for cattle, obviates all waste, and provides a fodder perfectly free from dirt of every kind. Can be arranged to thrash any description of grain crop. The only Thrashing Machines suited for India and hot countries.



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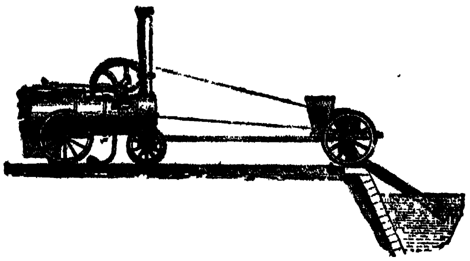

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TRANSPLANTING.

Will be ready shortly and Prospectuses will be circulated.

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Transplanting Tools.

SOME advantages of these tools are: the security that with very ordinary care no injury can be done to plants and roots. The swiftness, simplycity, and cheapness of working. The growth of the plant is not at all arrested in transplanting; it grows on as if it had not been shifted. Transplanting can be done at all times with little regard to weather. No vacancies of weakly trees from injured roots. The greatest care has been taken of strengthen all working parts. Specially devised to be put into the hands of "the coolie."

The proprietor of the garden where the transplanter and transporter had a thorough trial (only 80,000 seedlings were put out by three instruments, as more than half of the usual planting time had passed before these three in all parts finished instruments were procured) a tea planter of some twelve years standing writes incidentally to an acquaintance: the transplanter, &c., "is used in this garden with the most wonderful success, and now that I see "the machine in daily work I do not know how this or any other garden "would get on without," and has promised a further testimonial.

WINDMILL PNEUMATIC PUMPS.

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WATER raised to any desired height by air compressed by Windmill Power, on principles at once simple and effective, a few machines already in use in India; price from Rs. 400 upward.

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We quote the following rates for Machinery, &c., in our stock:—

6 H. P. Portable Engine by Clayton & Shuttleworth	Rs.	2,500	0	0
8 H. P. ditto ditto	„	3,250	0	0
10 H. P. ditto ditto	„	3,900	0	0
12 H. P. ditto ditto	„	4,500	0	0

8 H. P. and upwards are fitted with reversing Link Motions, Injectors and Spar Pulley.

6 H.P. Tangye's Stationary Engine with vertical Boiler	„	1,900	0	0
12 inches Centrifugal pump with Pipes and valves ...	„	1,400	0	0
10 „ ditto ditto	„	1,300	0	0
[illegible] „ ditto ditto	„	900	0	0
7 „ ditto ditto	„	800	0	0
6 „ ditto ditto	„	600	0	0
5 „ ditto ditto	„	500	0	0
4 „ ditto ditto	„	350	0	0
"Special" Steam Pump 4" × 2"	„	250	0	0
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Galvanized Barge Pumps	5 in.	55/	6 in.	65/		
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Corn [illegible]	No. 1	70/	No. 2	90/
Chaff Cutters	No. 1	35	No. 3	65/
Clayton's Brick Presses	No. 1	250/	No. 2	300/
Screw Cutting Lathes	7 in.	800/	8 in.	900/
Bench Drills	No. 1	250	No. 2	275/

Soorkie Mill 6 ft. pan	Rs.	850	0	0
Planing Machine 4′ × 2′ × 2′	„	1,800	0	0
3-ton Portable Steam Crane	„	4,250	0	0

Fencing Wire and Netting, Oils and Paints, Portland Cement and Asphalte, Metals of all kinds, Engineers', Carpenters', and Planters' Tools and Stores of all kinds.

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[IMPORTANT TO PLANTERS.]

TEA MANURE,

BASED UPON

DISSOLVED PERUVIAN GOVERNMENT GUANO,

PREPARED BY

OHLENDORFF & CO.,

London, Antwerp, Hamburg, and Emmerich-on-Rhine.

GUARANTEED TO CONTAIN

Nitrogen equal to 10 per cent. of Non-Volatile Ammonia.

"	20 "	Soluble	Guano Phosphate.
"	4 "	Insoluble	

Price, Rs. 165 per ton.

Delivered Free at the Godowns of the undersigned.

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NOTICE.

AGRICULTURAL PHOSPHATES COMPANY, "LIMITED."

I HAVE now to submit to you my report on the several samples of Bones and Bone Crushings you sent me for analysis. The result you will find arranged in a tabular form, upon which I have a few remarks to make.

I have stated the several constituents in such a way as will be most useful for economic purposes. The phosphoric acid present, for instance, may partly exist in the bones possibly (in very small proportion) as phosphate of magnesia or of soda, but that is more a matter of scientific interest than of practical value, so I have calculated it all as phosphate of lime, as is usually done.

The composition, on the whole, is tolerably uniform in all the samples, as will be seen by a reference to the quantity of phosphate of lime and of ammonia—the two leading and important constituents—in the various samples, and this will bee seen better by compering the proportion of these with that of the sum of the essential constituents, that is, excluding water and sand, which may be considered as accidental constituents, more liable to variation than the others from accidental circumstances.

The principal difference is produced by the steaming which removes the fatty or oily matters and some small portion of other constituents. It also diminishes to a small extent the proportion of phosphate of lime to that of the whole earthy salts, and so appears to increase the proportion of carbonate of lime, &c. The phosphates deficient probably exist in the bones in the state of soluble compounds, which are removed by the steaming, but from the smallness of the quantity this is of no great practical importance.

The steaming diminishes to some extent the proportion of animal matter, and consequently of ammonia. The bony matters become more brittle and does not retain water to such a degree as the unstreamed. The removal of the tough and glutinous animal matter will render the material more easily acted upon by the atmospheric water and carbonic acid, and so more readily assimilable by vegetation. It will also render it less liable to decomposition by keeping, and consequently prevent the result of that, namely, the escape of ammonia. This, I think, there can be no doubt of.

There are a few small discrepancies exhibited by the table which cannot be accurately accounted for. The large amount of sand in the bone dust may be due to the circumstance that the sand will naturally accumulate in the finer stuff: that of the raw bones from the amount of dirt adhering to them. As for the others, it is almost impossible, in an article like this, to be certain that the samples of the different varieties all proceed from exactly the same kind and mixture of bones.

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Carbonate of Lime with a little Magnesia, Iron and Alkalies, &c.	8·96	10·15	9·88	11·43	12 11
Animal Matter, dry	25·38	25·94	24·72	24·46	20·88
Essential constituents	88·46	93·45	89·90	91 78	88·60
Silicious earth and sand ...	2·92	1·47	·44	1·24	4·82
Water	8·62	5·08	9·66	6·98	6·58
	100	100	100	100	100
Ammonia yielded by complete decomposition	4·67	4·95	4·68	4·34	6·22

The Table speaks for itself. The numbers given are for the products in their ordinary condition, and sent to me. In some points of view it might be better to state the proportions of the constituents for the dry substances, that is, deducting water, or deducting both water and sand. This is a mere question of calculation by simple proportion.

DAVID WALDIE.

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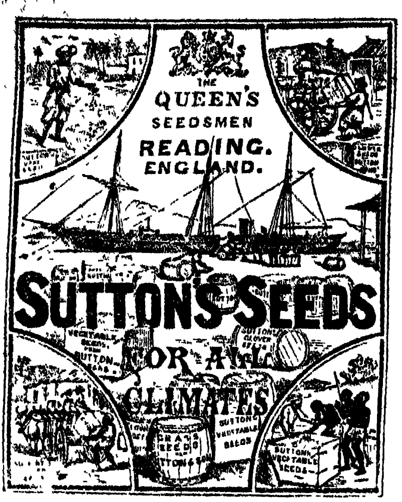

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THE INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. III.] CALCUTTA : WEDNESDAY, 1st MAY, 1878. No. 5.

NOTICE.

Mr. F. A. Cohen is appointed Manager of the STATESMAN AND FRIEND OF INDIA *Office, and has assumed charge this day.*

All communications concerning the general business of the Office, Advertisements, and Subscriptions to the daily STATESMAN AND FRIEND OF INDIA, weekly FRIEND OF INDIA AND STATESMAN, INDIAN AGRICULTURIST, *should be addressed to Mr. Cohen.*

All Remittances on account of the Office should be made, as heretofore, to Messrs. Nicholls & Co., Financial Agents.

R. KNIGHT,
Managing Proprietor.

Calcutta, 18*th April* 1878.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price*

Calcutta, 1st Feb. 1876.

R. KNIGHT.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

THE "*DOUBLE MHOTE*" WATER-LIFT.

From—The Deputy Commissioner, Damoh,
To—The Editor of the *Indian Agriculturist.*

SIR,—I see in several numbers of your paper, allusions to an improved water-lift, which with one bullock to work, will lift water enough to irrigate 3 acres of land. It is especially praised in your correspondent's (W.S.) letter from Coimbatore, in your issue of 1st August last. Could you put me in the way of getting a description and plan of the machine? I would have it put up in the public garden at my station where the Kachees and other irrigation cultivators could see it working.

Damoh, the 26th March 1878.

NOTE.—Apply to the Superintendent, Government Farms, Madras, for a model, and see also page 94 of our issue of March last.—ED., *I. A.*

A NEW PLANTAIN.

TO THE EDITOR.

SIR,—In this month's issue of the *Indian Agriculturist* (p. 113), a letter appears under the heading of "A New Plantain" signed by "W. H. L." Please kindly permit me, through your columns, to ask "W. H. L" whether it is in his power to procure for me, a few sucker-root bulbs of the interesting species of plantain described by him. The root bulbs should be *dried* (so far as the exterior crust is concerned) before despatch. If shipped at Calcutta, they can be received at Colachal in South Travancore. Of course, all charges will be paid by me. If similar root bulbs of the Travancore varieties of plantain (and there are many and some very good) are desired by "W. H. L." I shall be very happy to send them.

RAMA VARMA,
First Prince, Travancore.

ON FAMINE FOODS.

TO THE EDITOR.

SIR,—I think civilization has proved itself one chief cause of popular starvation, and famines may be considered largely due to the artificial life imposed on dependent races, by the masters of the soil. I know I shall be dubbed a heretic and an unbeliever, by the large politico-economic world of the time; but my experiences have been gathered largely among those primitive children of the earth—the Nomads of Asia and Africa—men whose wants are daily supplied from the stores of Dame Nature's gardens and granaries. For many centuries, the rulers of all lands have over-congregated their subjects into walled communities (cities, towns, and villages), teaching them to over-till their narrow fields, to overgraze their restricted grass plains, and to over-multiply against the unalterable laws of distribution: hence the consequent effects of that greedy system, in all the shapes of malignant disease, or widespread poverty and hunger; for, indeed, the "*earth is sick.*"

In fact, the prime law of numerical proportion, so many human beings and domestic animals to a scale of acreage, has long been ignored, though wide tracts of this beautiful world remain forgotten and untilled, teeming with wild vegetation, and clad with a virgin soil, ready to reward the industrious tiller of the land.

What does the inherent instinct of animals and birds command them to do, when the "clouds give no rain" and "the earth-springs dry up?" It tells them to disperse, and seek for sustenance in distant wildernesses; to travel fleetly in quest of food, and search for it unceasingly in forests, valleys, and unfrequented nooks. Are famine camps and relief kitchens, to continue the only Utopia of starving multitudes in this prolific land of the Sun? Has not Nature gifted the wide-spread Orient with fruginerous forests, and Eden-like orchards of indigenous growth? Could not civilized forestry devote some of its labours to increase and multiply the many wholesome esculent fruits and roots, natural to the woods and glens of India's highlands, where lakes never disappear and brooks are always bubbling, and where tens of thousands of her dusky children could camp in green tabernacles during drought, they and their quadrupeds? I think the scheme is quite possible in these days of rapid and easy locomotion, and it could be tested at no great expense. In the ever-to-be-remembered famine of 1837, there was an oasis in the desert, a tract of ground some 20 or 30 miles long in the Wynaad district, which saved life on a large scale. I allude to a wilderness of wild or semi-cultivated guavas, a fruit which attains the finest quality in Southern India, and is remarkable for increasing in quantity during extra dry hot years, producing famine. So renowned was this great supplementary supply, that regulations were passed protecting this tract and rendering it penal to cut or injure a tree; and I heard of its success in after years when I went to Madras. The apathy, indolence, and self-neglect of Asiatics (the lowest classes I mean) appear to me irremoveable, and the present action of their European masters is quite inadequate to meet such grave national catastrophes as famine; for the people relieved do not reciprocate, or assist in any way. Supposing that the English in India were numbered by *millions*, and that a similar dearth of market foods were to occur, money alone would not suffice to carry the white population through the crisis, but I feel sure that their inborn energy and inventive resources would do still more; they would strive with death and labour to feed themselves. The legion flights of small birds, the fishes which teem in in every pool and river, the various animals of the jungle, the green ownerless products of the earth, would all be utilized: in fact there would only be *less grain* consumed, *more flesh* and *vegetable diet*. The omnivorous Briton would bivouac in the sheltered valleys, or on the verdant uplands of "*Himmaleh*," surrounded by guns, nets, snares, *et hoc genus omne* of Sylvan paraphernalia; a ruddy-checked people born to the chase and war; not a priest-governed, caste-ridden, age-prejudiced nation, unable *to think or act*, even when spurred by the cruel pangs of hunger!

But as the men of "this ilk" are not *wise in thought*, we their conquerors must think and act to preserve their existence, and that too, with the most rigid economy. The Brahmin and the Rajpoot *will not dig, though not ashamed to beg*, and the aged and infantine Hindoo must be nursed at some cost. A large proportion of the strong agricultural tribes can earn their subsistence on reproductive works; there remain masses who need auxiliary measures of sustenance. Let all the waste waters and *meres* of Hindoostan be placed under a Conservator, and the rivers strictly preserved; only the rod and line fisherman to be free of their pisciculture; let all the waste lands near running water or natural lakes, be reserved as famine food tracts, for the culture of remunerative and sustaining crops; let an agricultural inspector be appointed to each Presidency, to take warning notes of deficient food-supply, and let the lower people be encouraged in the preparation of cheap dried products to be laid up in store for the day of hunger, as in Kashmir, where paupers frequent the half-wild orchards and uncared-for groves of fruit trees, subsisting while the summer sun lasts on the beautiful fruit crops; while they dry and press all the surplus gathering into cakes for the many long barren weeks of an Alpine winter. Apples, pears, quinces, mulberries, and many native fruits and berries of the bushes are so treated, and furnish a gratis Commissariat to needy hordes of wanderers. Besides this varied stock of wholesome nutriment, the wide watershed of that rich valley supplies *tons upon tons* of the *Trapa* nut. The Wullur Lake alone furnishes more than 100,000 loads of this excellent esculent nut, a great favourite with all classes of natives, and eagerly sought for in the markets. Then the *Fungi* of the grassy slopes and lesser woods, yield an abundant crop of satisfying diet, some *fishy*, others *fleshy* in their flavour, as I can testify who have tasted them all, and made a meal of them alone. Is it generally known that every part of the *Nelumbium* or "sacred lotus" is *edible*, and even *nice*, that it will thrive in every natural pool and swamp of India; that its capsules contain abundant nuts which have often alone supplied one with a meal (adding a little salt), and that they were as palatable as filberts; that in due season, they are collected and sold by sacksful in the village bazaars; that the roots are candied and pickled by the Chinese as a delicacy; that I have curried them, with the stalks also, adding a few prawns or small fish, and enjoyed the dish; that there are thousands of square miles in the Indian Empire where this beautiful aquatic thrives unseen and uncared for (particularly in the Terai); that in company with the caltrops nut and fisheries of the same waters, persons encamped in the vicinity could live for years (adding water fowl to their bill of fare); and last, not least, that all the required culture and conservation could be carried out for a very small sum! I know few food-products so remunerative or so sustaining, as the insufficiently appreciated *Arachis hypogæa* or *Chinee badam* of India, suited to poor sandy soils, wonderfully prolific, full of oil and feculent substance, wholesome, portable, and, while growing, only needing a minimum of irrigation, containing altogether a larger proportion of food matter to bulk than any other vegetable product. In the deserts of Africa, in the hottest and most barren parts of India, and in economy-loving China, it holds an equal place. I will give you a return in due time of 3 pounds weight, just planted in some poor soil. With a great fish-producing sea board, as in the Bombay or Madras Presidencies, how has it happened that great reserve-stores of desiccated marine *Algæ* and the finny tribes, have not long ago been created! The Maldives, Andamans, and Kurrachee hold an inexhaustible supply. We run too much after *rice*, and too little after equally and even superior life-sustaining commodities!

I have lived much among omnivorous savages—long-lived muscular, races—who liked rice or wheat or maize, when they could get it, but who did not care when the crop failed. They had their dry stock of smoked buffalo, deer, pig, birds, fish, &c., with a goodly addition of forest vegetables to mollify the banquet, and a dessert of not-to-be-despised fruits. In Upper Assam and its Indo-Chinese frontier, many excellent kinds of the wild yams, young and tender offshoots and suckers of *Bamboo*, the *Fern* varieties; many large *Fungi*, with *Dillenias, Pierardia, Garcinias, Zizyphus, Cissus*, &c. the primitive bow and arrow and quaint pitfalls and snares and nets, supplied fish, flesh, and fowl to these sturdy children of the soil.

In Southern Africa I saw the ever-present Hottentot fig (*Mesembryanthemum edule*), and a portulaceous shrub called "*Elephant's Food*," yielding sustenance to wild men and wild beasts; the fruit of the first-named is very nutritive, and even liked by the English settlers; the succulent acid leaves of the latter saving the life of those perishing from thirst in the trackless waste. The *cactus* jungles too, I must not omit, supply the lazy Hottentot and labour-hating Kaffir with a ready meal, when hiding in the bush, and the white man with material for his still. The esculent weeds of India are very numerous. I have really *enjoyed* many a dish of such green things simply cooked, as *Stinking Goosefoot* (*Butoua ke sag*), *Portulaca* (*Koolphee ke sag*) *Malabar Nightshade* (*Pæ ke sag*) cooked with small fish, Dandelion leaves, wild Water Cresses, shoots of the *Bauhinia variegata* and its young pods (*Kuchnar Kulli*), Ditto ditto of the *Moringa pterygasperma*, wild plantain stem, and queen fruit, and indeed every non-poisonous leaf and root. I have even eaten the curried stems and leaves of that pretty Bengal aquatic, *Convolvulus Reptans* (*Kulmi sag*), though it belongs to a highly purgative tribe of plants, it did not do me any harm.

When the fisheries are fairly established, the larger standing waters should be carefully stocked with all the edible aquatic vegetation I have described, and the low-lands above winter water level, sown with the nuts and roots noticed as "Famine Food." Carrots of the larger saccharine kinds, are also very supporting and pleasant diet; so are all the *Pulse* family. Trees of the nut-bearing kinds from South America and such hot countries, could be tried in the higher forests. Both Beech and Chesnuts would be very valuable if capable of introduction. I saw *Castanospermum Australe* flourishing at Bangalore in 1864; it was covered with capsules, but I do not know if the nuts are edible; they *seemed so* to the eye. Many years ago I sent Baron Mueller, of Melbourne, a supply of *Nelumbium* seeds, and he wrote long after, to tell me how well they had succeeded in those inland waters—lakes in fact—how delighted he was to introduce an edible plant for the sake of lost wanderers and hungry aborigines. I think the time has arrived to teach a little "Domestic Economy" in our normal schools and scholastic establishments of the sultry East, *viz.*, the curing, drying, and preserving esculents to meet the black days of hunger.

W. H. L.

Benares, March 1878.

BAMBOO AS PAPER STOCK.

To the Editor.

Sir,—I doubt not, you will give space for the accompanying letter on a subject, which I venture to think is of immense importance to India. I have forwarded Mr. Thomson's letters to Sir Jos. Hooker, which will, I trust, satisfy you as to the availability of bamboo, which I am *sanguine* in believing is destined to be the paper-making material of the future.

When the botanists (or some of them, the *doubters*) have settled their *doubts* as to the possibility of continuously producing and cropping it, it will rapidly develop. We *English* paper-makers would much prefer drawing our supplies of raw material from India, than to be dependent entirely, as we are, on foreign countries. English commerce and shipping would share these advantages, to say nothing of the benefit to India generally.

Jute was as much sneered at as esparto was, and as bamboo now is, and what an important produce is it now ?

Bamboo is a grass—why therefore not amenable to the ordinary treatment of grasses? Under irrigation, grasses admit of almost continuous cutting or cropping. Why not bamboo ? Plant thickly, cover the ground, cut, and irrigate ; but leave a few stems standing to continue vegetative functions of the root stools. Then next cropping, cut for fuel. Bamboo grows—When ? Immediately the rains set in, showing it is a water-loving plant. Why not indulge its proclivities ? Any way do not dry up the plant, or dry up the subject—let it be tried.

I think you will consider Mr. Thomson's letter worthy of attention. It is hardly necessary for me to discuss its tenor, as it is clearly written, fully entering into all details. Should more be desired, I have Mr. Thomson's permission to say he will be happy to reply to any communications of your correspondents.

The French say "ce n'est que le premier pas qui coute," and I trust this may very shortly be the case with bamboo, as once launched, the plant will grow quickly enough and strong enough to take care of itself ; although, as Mr. Thomson remarks in his letter, a slight weeding may be needed in the preliminary stages of its growth.

I am naturally anxious to shorten the probationary period, as far as possible, and look for your kind co-operation.

Claxheugh, Sunderland.

THOS. ROUTLEDGE.

P.S.—Mr. Thomson has been spending a few days with me here, making imself acquainted with my process of preparing the stock, which with ome slight modifications, is the same as I employ for esparto, of which am using from 140 to 160 tons weekly, making paper therefrom as well s stock for sale to other paper manufacturers. I only wish we had bamboo n its place. This esparto stock, however, sells freely ; but that from amboo under fairly favorable conditions, would be produced and aid down in England as cheap, yielding a good profit to producers.

Enclosed is a piece of the bamboo, boiled and pressed. Soak in warm ater, and note the beauty and strength of the fibre. It also bleaches reely ; indeed is far superior to esparto in every respect.

The following is Mr. Thomson's letter referred to above :—

DEAR SIR,—With reference to your letter of 30th December last, ddressed to me in Jamaica, and which I only received a few days go, it having been returned to me here from Jamaica, I beg to submit y further views on bamboo cultivation.

Jamaica has a very striking variety of climates in the lowlands, ore or less suitable for bamboo growth. This variety of climate as been caused by the improvident destruction of the forest. Bamboo n the drier plains presents a shrivelled and stinted aspect, except hen within reach of water, which ensures its wonted luxuriance ; it erefore assumes its greatest luxuriance ; in the most humid districts. any hundreds of acres of certain districts are densely covered ; for stance, a certain part of the parish of St. Thomas is literally overed with it. The plant flowers and yields seed in Jamaica under ry exceptional circumstances, so that seeds are rarely seen. I have ever been fortunate enough to see it in flower. It has been idely distributed owing to the readiness with which cuttings ow in most climates. The ripe stems are commonly used to form fences, e post and rails consisting of the stems ; the posts, if placed in the ound prior to the rainy season, take root, and unless they are equently trimmed become irrepressible thickets. Ripe stems of edium size are not uncommonly used by the Negroes as poles on hich to support each plant of yam, which climbs over the pole in eir cultivated "provision grounds ;" these stems in like manner ow. This will explain the facility with which the plant is propated. Though it is likewise propagable by offsets or rhizomes, I think, wever, the stem process of propagation would be in every respect eferable.

With regard to the question as to the period required to produce crops by planting," I am quite sure that this period could not be ninished by planting offsets from established stools. It should be nembered that by any system of propagation of the bamboo the first ocess of rooting is very simple ; the result of the first roots is the duction of slender, twiggy shoots, but as these latter become tured the increased vigour of the root action creates stems with portionately increased strength, and so on step by step until the ly developed stems are producible, the whole length of time, from time of planting, as I have already mentioned, for the maturation the crop being at least two years.

An individual stool, if influenced only by the ordinary rainy sons, I think, would not produce more than one crop in a season ; but under a system of irrigation I am strongly inclined to believe that two crops would be producible. For the wants of the paper manufacturer it will no doubt be supposed that the available command of bamboo obtainable may be turned to account, instead of having resort to the formation of plantations. I will, however, briefly endeavour to show that a regular plantation possesses immense advantages. The existing bamboo, though only a few miles from shipping ports, is not so conveniently situated as it would be in a special plantation, on which the most advantageous and accessible spots would be set apart and systematically planted in a series of plots, in order to facilitate and economise cutting and carriage. The advantages thus indicated would be considerable, but the great advantage of planting bamboo would be that of having it brought under the influence of irrigation, as it is peculiarly a water-loving plant.

It is well known that general crops of bamboo shoots are only produced after heavy rains, a fall of from 15 to 30 inches ; such rains usually occur two or three times a year in Jamaica ; the time young shoots take to spring from the ground up to about 25 feet (they are at this height in a fit condition for your requirements) after such rains averages five weeks. Irrigation would produce constant action at the roots, and there can be no doubt that by the process of cutting, which I advocate (*vide* my letter of the 6th Nov.), several crops a year may be secured ; indeed, a continuous succession of cropping could be assured by systematic cultivation and irrigation.

To those who have not visited the tropics it is impossible to conceive the extraordinary luxuriance of this gigantic grass. The description you give in your valuable pamphlet is far short of its majestic grandeur.

In laying out a plantation, I think that cuttings should be set about four or five feet apart ; thus by planting thickly the intervening surface would be expeditiously occupied by the stools, and this system ensures the benefit of fostering among the plants a reciprocal tendency to shoot upwards.

The cost of planting would be about £2 per acre. After planting four or five weedings, costing ten shillings, would be given during the two years required to establish the plantation. Subsequently to this cultivation would be absolutely dispensed with, except the application of water and a judicious system of cutting out the stems.

The Government of Jamaica has constructed at great expense magnificent irrigation works on the St. Catherine Plain, surrounding Spanish Town ; and as very little advantage has been taken of this precious adjunct to tropical agriculture, land is obtainable at a very cheap rate, and it is most conveniently situated, as the railway connects it with Kingston, only 15 miles distant.

The irrigation works are constructed to irrigate upwards of 14,000 acres, but only a few hundred acres of cultivation have actually been brought under the influence of this water. Labour would be abundantly obtainable at 1s 6d. a day ; hundreds of strong negro labourers would be at command all the year round, and for rough and continuous hard work the negro is far superior to the coolie, and they prefer any kind of work to sugar estates work.

The Government undertake to supply a quantity of water (as I mentioned in a previous letter to you) equivalent to a rainfall of 60 inches a year for £1 per acre per annum ; this is very moderate, as it would certainly double or treble the crops of bamboo annually as compared with the ordinary seasons. The average rainfall of the locality in this irrigation scheme is about 40 inches.

Our bamboo is *Bambusa vulgaris*, but, of course, you are aware that all the varieties are most productive in localities in which moisture is most abundant. This is a most important consideration, in view of the production of bamboo in Jamaica, and one which has, perhaps, not received any attention, the variety of climate as regards moisture is very remarkable. The destruction of the forest in most parts has materially lessened the rainfall ; certain districts are too dry for bamboo to exist in, others only afford sufficient moisture to maintain the bamboo in a condition of very partial luxuriance ; it therefore follows that districts having a constant precipitation of rain, with a normal average of from 80 to 100 inches a year, are best adapted for this plant. Astonishing crops under irrigation, therefore, would be obtainable at a small cost of production, for it would require little or no cultivation beyond its first establishment.

I agree with you that it would not answer to export the bamboo in any other way than manufactured into paper stock, not only on account of the great difference in the cost of transport, but owing to the deterioration of the article in transit, when it is sent in a crude state, due to the difficulty in drying the young stems, even after crushing

I may mention that before your pamphlet was published I was impressed with the notion that bamboo was destined to become the most valuable of all materials for paper-making, by reason of the quantity of it producible per acre, a quantity of fibre far greater than can be produced from any other plant, a fact to which you have referred. It should be remembered that bamboo grows its whole height in a few months, that the great bulk of it is composed of fibre which is convertible into paper stock, and that it produces its stems so closely, that is to say, each stem about 60 feet high (*Bambusa vulgaris*) occupies about half a square foot. Thus it does not require, as you state at page 8 of your pamphlet, two feet ; half a dozen at least grow within two feet. Indeed, I should scarcely like to say what quantity of bamboo may be realised per acre, but it may be safely predicted that it will be so large that it will revolutionise the paper trade.—Remaining yours truly,

ROBERT THOMSON.

11, Queen-square, Bloomsbury, London,
22nd February 1878.

OPPRESSION OF RYOTS IN TIRHOOT.

To the Editor of the Englishman.

SIR,—A great deal is said about the cruelty, oppression, and injustice of indigo planters in this district to their ryots. However true such accusations may be or not, I will not here discuss. I hear these stories are generally much exaggerated, due at times to the ignorance of officials. I will, however, give you an instance which has come under my notice of the charity, kindness, and consideration with which the Courts of Wards and their responsible servants sometimes treat their tenants. Imagine a large and prosperous village burnt, razed to the ground in one fell conflagration. The houses are roofless, the walls are blackened, charred, and dreary; the poor, miserable inhabitants creep about, cooking their food as they can, in any corner which shelters them from the wind, in any shade where the sun does not render the light of their fires lusterless. Exposed to the fierce west winds, the blinding hot dust, the damp, cold east winds so injurious to a native, without an awning for their heads, save here and there an improvised roof of a few palm leaves and some of the blackened bamboos and withered thatching that has escaped the general ruin; tormented by heat and flies during the day time, and running dangerous risk at night owing to the sudden change of atmosphere to cold and damp,—behold the inhabitants of a whole village suffering thus; and why? Is there no helping hand or voice to enable them to re-thatch their houses, and re-build their walls, to lift them from the dire necessity into which they have sunk? Does no railway run near them? Yea, verily through their very midst? Does no thannah exist close to them? Yes, indeed quite close. Is there no thatching grass to be had for love or money in the neighbourhood? Ah! here's the point. Whose is that waving, glinting grass jungle of 100 acres or thereabouts laying so near their houses? Doubtless it belongs to some other village, perhaps to some cruel, hard owner who laughs in his sleeves and says: "Wait! wait till the sun gets hotter; wait till the rains approach, then! then you'll have my grass—at Rs. 20 a biggah." But strangest of wonders, and most painful in this painful scene, the grass belongs to the village, the village to the Court of Wards, the Court of Wards to Government! Oh! noble institution, oh! fit example to planters and zeminders, fit leader of right feeling, and kindness and generosity to ryots, oppression is your bugbear, selfishness your abhorrence! How oft you shudder when a planter's feeble oppression is brought to your notice by a lying patriot, or when a native zemindar has shown his love of lucre by grinding down his tenants. But you, have you no pitying ear to the groans and tears of the half-starved, half-naked women and children suffering in their roofless houses? Strange indeed, and yet a fact. The grass remains intact, the houses remain roofless, and disease and dirt, and misery, merrily embrace on the hearths, and why?

Cry out oh! Exeter Hall; shout ye Irish members: write you English papers, here is matter for you all!

The grass is to be kept for a pig-shooting Maharaja! The ryots may die; the ryots may suffer; but who shall prevent the Maharaja shooting his pigs. Not you, oh! Court of Wards; not ye, oh! noble-minded officials, —unless you do it quickly.

A TRAVELLER IN TIRHOOT.

COTTON ADULTERATION.

To the Editor of the Times of India.

SIR,—In an article in your issue of the 9th instant you used the following words:—"That official supervision for the prevention of cotton adulteration as exercised in the Kattywar States is denied by Mr. Graham, who particularly mentions Limri as a state in regard to which he possesses documentary proof to show that such is not the case. Perhaps, however, the British political officers are more reliable than Mr. Graham's informant, and we have the statement from one of them, quoted in the last annual report of the Cotton Department, that in Limri, the police have been directed to find out persons who adulterate cotton."

I do not consider myself in a position to enter into the controversy regarding the advisability or otherwise of repealing the Bombay Cotton Adulteration Act, but I am able to state a few facts which may be of interest.

The exportation of cotton from the Kattywar Native States has been officially asserted to be equal to one-sixth of the whole exportation from the Bombay Presidency. This being the case, it must be admitted that the quality and condition of the cotton from Kattywar is of some importance.

I can assure you that there is no real check on adulteration in the States, whether of Limri or any other. It is all very well for the officer who was in charge of Limri not, by the bye, a British officer; but a native, to say, "the police have been directed to find out persons who adulterate cotton;" but what were the results? Had he any authority to punish such persons? Merely to give an order is one thing to have an establishment to see to its being carried out, and to enforce the order, is quite another matter. Nothing was done in Limri. Others of the States have given similar orders to please the political officers, but have entertained no establishments, and have done nothing to check the evil to any appreciable extent. It was proposed to introduce a short law similar to the Act into the Gondul State, but I cannot tell if this has been done. I do know that a larger purchaser of cotton residing in the Gondul State, a European gentleman, was exceedingly anxious that some restriction should be placed on the open and shameful adulteration which went on, and urged the matter continually on the Agency officers; others deeply interested in obtaining good and clean cotton have done the same.

When intimation was given in Gondul that adulterators would be watched, they threatened to remove their cotton "yards" into a neighbouring State where, they openly said, they would adulterate as they pleased. The strange intermingling of the territories of the numerous States would enable them to do this by going a mile or two on either side. Mixing up the long and short staples goes on openly everywhere; if the trade like the mixture, they certainly ought to be satisfied. Here is a fact which speaks volumes for the acuteness of Bombay buyers. Cotton from Gondul and the neighbourhood sent to Verawul, which had acquired a bad name for the exportation of adulterated cotton, fetched such and such a price: cotton from the very same fields sent to Bhownugger passed as Dhollera and fetched from one-fourth to one-third a higher price.

GUZERAT.

The Indian Agriculturist.

CALCUTTA, MAY 1, 1878.

OUR GOVERNMENT AND OUR AGRICULTURE.

WE have, more than once drawn attention in these pages, to the intimate relation between the state of the soil and the condition of its cultivator. We have endeavoured to show how the condition of the former affects the latter, and have given ample proof that, as regards this country, the poverty of the ryot stands in direct relation to, and is in close connection with the poverty of the Indian soil. We have published unassailable evidence, that India's fields are in a chronic state of exhaustion, the result of a spoliative system of agriculture, extending over centuries past, and we have shown that the yield of the three or four inches of soil cultivated, depends now chiefly upon the quantity of plant-food, rendered available from harvest to harvest, by the decomposing influence of moisture, heat, and atmospheric air. The yearly harvest depends upon a hand-to-mouth system, and a corresponding condition of the cultivators would follow as a natural consequence. The last two years have shown, that the failure of a single harvest in any portion of this great empire is sufficient to create a famine, and that the increased area of cultivation, on which so much stress is laid by those who point to it as a proof of the improvement and development of the country, does not enable the rural population to lay by sufficient stores of food in favourable seasons to provide against bad ones. We admit the fact, that in some agricultural districts the area of cultivation has, during the last thirty years, increased by nearly thirty per cent., but it does not follow that the quantity of produce has increased in the same ratio. Lands have declined in fertility steadily throughout that period, and what balance may remain in favour of the extension of the area under grain crops, is counteracted by inferior cultivation. Pastures and reserves have been broken up, and consequently the percentage of cattle to cultivated area has been considerably diminished.

All we have said in previous issues, on this important subject of the exhaustion of the Indian soil, recurred to our mind on perusing a pamphlet on "Agriculture in Behar; as it is and as it ought to be," by Mr. D. N. Reid. We believe we are not isolated in our views on the condition of Indian agriculture. Gloomy though they are, they are shared by the majority of men who have given any attention to the subject; otherwise, we should feel satisfaction in laying before our readers the opinions of a practical planter, who is living and has been living for years amidst the ryots, in one of the great agricultural districts of this country, Behar.

Exhaustion of the soil, caused by continuous cropping, side by side with a reckless destruction of almost all the manurial matter available for its restoration, Mr. Reid shows in his pamphlet, to be the principal cause of the poverty of Behar, as we have endeavoured to prove it to be the cause of the poverty of the ryot throughout India. The remedy lies in the hands of the landlords, the virtual owners of this immense estate; it lies in the hands of our Government. But Government is slow to be convinced that the very foundation of the empire is being undermined by this yearly increasing poverty of the soil. It refuses to see the causes which have brought this result about, and has, as yet, given no sign that it intends to devote any of its time to take into consideration such measures as are calculated to alleviate and remove them. It refuses to give Agriculture that share of attention in the administration of the country, which it needs, and governor after governor comes and goes, without our being a step nearer to the improvement of the native system of agriculture, than which no greater benefit, said Lord Mayo, could be conferred on the agricultural classes.

The Government cannot say that it is ignorant of the backward state of Indian agriculture, it cannot say it is ignorant that improvement is urgently called for. Attention has repeatedly been called to it in the last ten years; we have discussed the measures calculated to effect such improvement, we have shown when and how an inexpensive beginning could be made, to develope the sleeping resources of the soil. We have asked for an Agricultural Department, presided over by a Minister of Agriculture (*not* by a Collector of Statistics); we have asked for agricultural education; we have asked for a department for the conservancy and development of the vast manurial resources of this country; we have asked for selection of seed at central farms; we have asked for prizes to be given to the zemindars, who produced the largest yield per acre, who had the finest cattle; and for distinctions to be held out to those who showed themselves prominent in improving the native system of agriculture; we have called for prizes for the best deep-going ploughs, adapted to the cattle and to the soil of this country; for deep tillage, and we have shown what were the results of such in seasons of drought, where all around crops were dying for want of moisture.

And now let us ask—has Government given the least indication, that this subject of improving the native system of agriculture, of staying the exhaustion of the soil, of removing the real cause of the poverty of the ryots—the cause why the failure of a single harvest results in a famine,—has Government, we say, given the slightest indication that this subject, than which there is none more important, is receiving its attention?

Has even as much as an allusion been made in any of the speeches referring to famine and taxation, to the neglected state of Indian Agriculture, as calling for immediate attention? Has Government vouchsafed a word to assure us, that agricultural improvements will not be forgotten, when the measures to insure against future famines will be discussed? We trust that some of the members of the Commission of Inquiry will draw prominent attention to this subject. As far as Government is concerned, it ignores the real causes of Indian famines. One of our best authorities on agricultural subjects writes to us, under date of February 25th, anent the Famine Commission:—"It is clear that the *Agricultural Question* is not to be ventilated, if it can be avoided, and our only hope is in the men, selected to make the enquiry, having sufficient independence to back out of the leading strings prepared by the Secretary of State."

Government will probably propose to supply the means of unlimited irrigation, to stimulate the soil to the utmost, and force a fertility for a few years, to be followed by a severe re-action, and temporary sterility. We shall then have ample opportunity to confirm the observations of Colonel Corbett, regarding canal-irrigated lands under the native system of agriculture. Soils which have yielded for years, fair and remunerative wheat crops, will gradually cease to do so, and only grow an inferior crop, say rice; while previous rice lands may have to be abandoned to reeds and rushes. "Water alone," remarks the *Oriental*, in an article on 'Irrigation Works in India,' "will not help the land to produce crops that would, after paying the land-tax and heavy water-rates, support the agriculturist; the land is poor and pretty well exhausted, and, until manures are introduced and the agriculturists are taught and induced to use them, the land will not yield much more than it does now."

To spread over the country a net work of railways, will be, to give additional impulse to the exportation of food-stuffs, to increase the present area of oil-seed cultivation, to reduce still further the already insufficient pastures and preserves, and benefit only the dealer and village money-lender. But railways are very doubtfully calculated to benefit the ryot, in his present condition of chronic poverty. Railways will, of course, facilitate the transport of food-stuffs in times of scarcity to the suffering districts; but Government will, as heretofore, have to feed the starving, for the ryots, living as they do from hand to mouth, and embarrassed with their own and their father's debts, have neither money nor credit to buy the food, even when brought to their very doors.

Neither canals nor railways, are likely, *primarily*, to assist the agriculturist. He will continue in poverty, in years of plenty, and will fall back helpless upon the support of the State, in times of scarcity. There is a growing conviction among those who have studied the present condition of the country, and compared it with what we know was its condition in the last century, that British rule and administration, with all the blessings of peace, security of life and property it brought, has benefitted and enriched but the middle and upper classes. In all but the sparsely populated provinces, it seems to have impoverished and reduced to the utmost indigence the vast rural population, the actual cultivators of the soil.

In improving the empire, and developing its vast resources, we have commenced by strengthening and improving the top of the house instead of beginning at the foundations, and the result is that the foundations are getting weaker and weaker, under the yearly increasing weight they have to bear, and their weakness imperils the safety of the whole structure. By all means, let us have canals, railways, telegraphs, external commerce, and all the other blessings of civilization; but we must not forget that Agriculture and the Ryot are the mainstay of empires, and that unless we improve the agriculture of this country, and the condition of the agriculturists, the other blessings of civilization, canals, railways, etc., will be of little avail. Improved means of communication, railways, telegraphs, canals, British administration of the law, and all the other blessings of civilization we have conferred upon this country, are of little use, as long as we do not begin with the beginning, with the ryot, and an improved system of agriculture. Soil and cultivator are inseparable from each other. The poor, starved ryots are verily the children of a poor, starved soil.

It is becoming almost painful to us to write on this subject. From the last Administration Report of the Central Provinces, we see that, at the Nagpore Model Farm, as much as 1,601 and 2,200lbs. of wheat were obtained per an acre under an improved system of agriculture; while the average outturn of the surrounding district under the native system of agriculture, is only 400lbs. per acre. And again while under the native system of agriculture only 80lbs. of clean cotton are obtained per acre, an improved system gave 326lbs. per acre. And these returns are by no means exceptional; they can be obtained from all average soils throughout the country, and they are not in excess of what an acre yields in Europe under the ordinary system of cultivation there in vogue.

Commenting on these facts, the Secretary of State desires to be informed what steps are being taken to communicate these results to the agricultural community generally. But with its usual indifference, Government satisfies itself with alluding to these important facts, in the Administration Report. No details are given, under what circumstances and by what particular treatment these yields were obtained; neither have any since been forwarded to us for publication. It is impossible for us to write in every instance to the authorities for papers of interest to the *Indian Agriculturist;* we must rely upon Government to forward them to us. The public has reason to be very dissatisfied with the steps that are taken by Government to keep it informed of such agricultural improvements, as are being introduced into this country. We know that there are a large number of agricultural experiments conducted at the expense of Government, but we very rarely hear anything about them, until we find them in Administration Reports.

There is no guiding or directing mind, to take these experiments in hand and interpret their results, and the consequence is, that experiments are going on at the expense of the State, to elicit facts which have been proved hundreds of times before, and are acknowledged by all scientific men. Reports of purely agricultural interest, such as the report of the Superintendent of Government Farms, Madras, are retained by Government *for nearly two years*, before being placed at our disposal, and many others never reach us, but are simply buried in the Government archives.

The indifference with which Government treats the claims for the improvement of native agriculture is most culpable, and we almost despair of it.

AGRICULTURE IN BEHAR.

AS IT IS AND AS IT OUGHT TO BE.

WE have alluded in the foregoing article, to a pamphlet bearing the above title, by Mr. D. N. Reid, a well-known indigo planter, who has been living for years among the rural classes of Behar, and whose opinion on their condition, is therefore deserving of every publicity we can give to it. The burden of this little pamphlet, is to give a plain and truthful account of the way agriculture is practised in Behar, and to show why the peasantry are in such a poverty-stricken, helpless state. Agriculture in India, says Mr. Reid, is a subject which has received too little attention from the ablest men in the country. The members of the Civil Service and those who have taken up the matter, have done so in a desultory manner, devoting little time to it; and therefore, not having thought the subject out, have proposed extravagant and unpractical reforms which might do well for a rich and intelligent set of agriculturists, but which cannot possibly be adopted by the poor and ignorant peasantry of a country in which the prevailing rate of interest, paid by the body of the people, is 37 per cent.? With all our good intentions, it is a notorious fact that the masses are worse off now, than they were before our elaborate rent-laws were framed. When the proprietors are as ignorant as the peasants, and utterly blind to their own and their children's interests, it is folly to expect an improved system of agriculture, unless it is introduced by intelligent men whose interests are enlisted in the undertaking. The present mode of agriculture is the one, practised centuries ago by their forefathers; the same wasteful expenditure of fuel and manure exists, while there are now no longer tracts of virgin forest land to fall back upon.

Mr. Reid confirms what we have so often represented to Government, namely, that under the present system of agriculture the peasant is living almost entirely on the capital of his land. The system has already told its own miserable tale, in our frequent famines and in the exhausted state of the soil; and Mr. Reid proves, if further proof were necessary, how this has been gradually brought to pass, by reviewing each principal crop in turn, and showing the use made of its grain and straw by the peasantry.

In North Behar there are 6,034,361 acres under cultivation, divided as follows :—

Sarun	1,499,829
Champarun	1,437,393
Tirhoot	3,097,139

The principal crops grown are—poppy, flax, mustard, and rape (for oil-seeds), sugarcane, cotton, *Sun*, hemp, *putua*, tobacco, *arhur*, paddy, wheat, barley, peas, millets, and indigo. The *poppy* plant takes up 173,133 acres of the best homestead land in North Behar. It is an exhausting crop to grow, as in no way is it a manure-producer. Poppy is cultivated in the same field year after year without a change. The remainder of the ryot's holding is too poor to grow it, although the crops from it have to supply all the manure that is required for the poppy field.

Flax, mustard, and rape occupy 400,873 acres of land in North Behar. Making an approximate average of the amount of *rubbee* sown annually in North Behar, Mr. Reid estimates it at 1,603,492 acres. Flax, mustard, and other oleaginous plants are largely mixed with the barley and wheat crops. Mr. Hunter, in his statistical account of Sarun, considers that one-sixth is the proportion of seed sown; but Mr. Reid thinks that one-fifth is the proportion to the produce reaped. He bases his estimate on averages taken personally, and in consideration of the enormous local consumption, and the amount exported to Bengal and Calcutta. The refuse oil-cake is given to the draught cattle; and as there are over 40,000 carts in the three districts: the consumption of oil-cake alone therefore may be imagined.

Mr. Reid shows how the land is drained of its resources by the cultivation of these exhaustive crops, almost unaided by manure, and then states how these crops are cultivated by the ryots of Behar. There are two ways of sowing the seed; the most general is to mix it with the seed of wheat and barley, and sow broadcast in October; the other way is to scatter linseed over the wet surface of the paddy fields. Mustard seed is also sometimes sown by itself in very strong lands; but as a rule, it is mixed with the other rubbee crops, and pulled by the roots when ripe; the seed is then beaten out, and the stalk used as firewood. Flax is generally cut along with the other crops in the field; and the tough stalks, which do not break into boosa, are separated and used as fuel. The seeds of these plants, required for home consumption, are sent to the village oilman, and the surplus stock is sold to the *bunia* for exportation. The husk is the only part used as fodder, with the exception, of course, of the oil-cake. Everything is sold off the land, nothing returned, and this is the way the natives treat the crops, a way specially prohibited by land-owners in England.

Sugarcane.—The approximate area under cultivation of this crop is in—

Tirhoot	20,000 acres.
Sarun	12,000 „
Chumparun	12,000 „
Total ...	44,000 acres.

A few sentences from Mr. Hunter's "Statistical Account of Bengal" are quoted to show how this crop is treated. "This crop is grown on rich and high land. The ground is thoroughly manured. After the raw juice has been expressed, the refuse cane is dried in the sun, and used as fuel for boiling the produce down into *gur*." As in the case of poppy cultivation, outlying lands have to furnish manure for this exhaustive crop!

Cotton.—There are	24,000	acres in Tirhoot.
	18,000	„ in Sarun.
	10,000	„ in Chumparun.

Total approximate area 52,000 acres under this crop, in the abovenamed districts. It is never sown separately, but is grown together with *makai*, *kodo*, and *arhar*. After picking, the seed is separated from the fibre. The seed is extensively used as fodder for draught cattle, and the fibre, after being cleaned, is woven into cloth for local use. The stalks are used as fuel.

Sun and *putua.*—Approximate area under these crops in the three districts, 13,986 acres. The crops are not grown for exportation, but for local consumption. The *sun* plant is exclusively cultivated by the *Damook* caste, who prepare it for market. The *putua* plant is cultivated by all classes round the borders of their fields. The fibre, stalks, and refuse of these crops are never retured to the soil.

Tobacco.—In Tirhoot .. .	40,506 acres.
„ Chumparun .	160 „
„ Sarun	500 „
Total . .	41,166 acres.

The ground requires to be very heavily manured before this crop is planted. It is the most exhausting of all the cultivated plants, and does not return a particle of manure to the land that bears it.

Arhar.—There are 1,551,492 acres under this crop. It is a luxuriant-growing leguminous plant, which reaches the height of 9 and 10 feet in favourable soils. It is sown along with *kodo*, *makai*, and the cotton plant in June, and is cut the following March, after occupying the land nine or ten months. It thrives only in well-drained land, not liable to inundation. This plant is the principal one with which the natives of Behar attempt a rotation of crops. Say, for instance, a ryot has four beegahs of high outlying land, he sows two beegahs in *arhar* and *kodo*, or *arhar* and maize, and keeps the other two beegahs for a crop of *rubbee*, probably taking a light crop of maize off them if so inclined. The following year the two beegahs that bore the *rubbee* crop are sown with *arhar*, and maize or *kodo*; and so this simple system of rotation goes on year after year without change. If the leaves of the plant are not gathered by the ruthless hands of *Nunya* women for the saltpetre works, they are allowed to rot on the surface of the land, and thereby, to a certain extent, enrich it. After the crop is cut, the seeds are beaten out and used as *dhall*; the *husks* are given to the cattle, and the stalks reserved for firewood.

Paddy occupies 2,352,680 acres of land in North Behar, which land, Mr. Reid confidently asserts, has not been manured since it was first reclaimed. Very little of the grain is exported, and the straw is cut up and used as fodder for the cattle.

Wheat, barley, peas, maize, and millets occupy 1,202,619 acres, double-cropped. The produce of these crops is wasted in much the same way as the others, as the solid excrement, supplied by the cattle from the straw, is chiefly kneaded into cakes for fuel. It is only during the few months of the rainy season that native cultivators ever think of folding their cattle on the fields; and it is for this short period only, that the land reaps the benefit of its own produce. And see how gratefully it returns the attention paid it, as fields so treated produce nearly double the quantity of opium, oil-seeds, and food-grains, they otherwise would if treated in the ordinary way.

Indigo.—Mr. Reid closes his review with the only crop, that is cultivated at all, on rational principles, in North Behar. It occupies

	97,462	acres in Tirhoot.
	60,000	„ in Chumparun.
	45,000	„ in Sarun.
Total ...	202,462	acres.

The indigo is a leguminous plant, which grows to the height of five and six feet in good land. In these three districts, it generally gives two cuttings in the year; the first (*mohron*) is reaped in July and August; the second (*koontee*) in September and beginning of October. The plant is not allowed to mature its seeds, but is cut in a green state. The average weight of the produce of the first crop is 55 cwts. per acre, and the average weight of the second cutting 20 cwts. per acre. Total 75 cwts. of green plant, carted from the field to the vat. It is steeped for 10 or 12 hours in water, for the purpose of extracting the colouring matter, which on an average, amounts to 16 seers of prepared dye, ready for market, for every 100 cwt. of plant. If the planter is a careful and good agriculturist, he throws the refuse plant on to his empty fields, and has it dug into the soil; he also bales the refuse water on to the fields, or turns it into the nearest paddy *chowr*, where it acts as a most valuable fertiliser. Those favoured *chowrs*, which receive the refuse indigo water, produce three heavy crops in the year—one of paddy, one of oil-seeds and barley, and one of *cheena* (*panicum miliaceum.*) The *seet*-water, as it is called, is a most powerful manure, and has been analysed for Mr. Reid by Mr. Schrottky, whose report follows:—

"INDIGO REFUSE WATER."

(Manurial Properties.)

Free ammonia per gallon	45 grains.
Total solid residue „	333 „
Consisting of organic matter	301 „
(Containing nitrogen 22 5 grs., equal to ammonia 27 3 grs.)	
Inorganic matter (chiefly potash, lime, and magnesia	32 „
Total ...	333 grains.

"The manurial value of the indigo refuse water is very high; it is higher than town sewage, and I would recommend it to be used for irrigational purposes, diluted with about ten times its volume of spring or river water."

A factory with 1,000 acres of indigo plant, produces about 4,400,000 gallons of *seet*-water per annum. If this is spread over the land at the rate of one inch of water per acre, it is sufficient to highly manure 195 acres. The refuse plant, or *seet*, is capable of manuring one sixth of the cultivation, say 160 acres. Total 355 acres of land per annum. Now, if this is all that a heavy manure-producing crop is capable of returning to the soil, *viz.*, manure sufficient for one-third of the land cropped, it can easily be imagined what a very small way the ryot's stock of manure goes, under his wasteful system of burning and storing near cesspools.

Land manured with the refuse plant (*seet*) is esteemed so highly in tobocco-growing districts, that instances have been known of ryots offering Rs. 20 per beegah to take a single crop of tobacco off the land. In fact, land is increased one hundred per cent. in value by being heavily manured with the indigo plant, or its refuse, and it lets readily at double its former rent. *There is nothing extraordinary in the indigo plant as a manure, says Mr. Reid, except the fact that, being a legume, it absorbs a considerable amount of ammonia by the leaves; and a field in which indigo has been cultivated is enriched with nitrogen; therefore, on this account alone, the cultivation of this plant is of the utmost importance in regard to the rotation of crops. Where factories are situated in sugarcane-growing districts, a crop of sugarcane always succeeds indigo when a field is given up by the planter.*

Mr. Reid next proceeds to show, in what way the manurial resources of the country are diverted from their legitimate use as restoratives of the fertility of the soil. He states that not only is the daily meal of the peasant in Behar, as elsewhere, cooked with fuel which rightly belongs to the soil, but a number of special causes combine to make the destruction of manurial matter more complete than in most other parts of India. Behar annually produces 682,926 maunds of saltpetre, which, in its natural state, represents so much valuable nitrogenous matter lost to the fields by being allowed to soak into the village sites in the shape of the liquid excrementa of cattle, and the extraction and refining of which again involves the destruction of between two and three million maunds of other manurial matter in the shape of the cow-dung, straw and leaves, used to feed the fires of the 180,000 *Nunyas* who live by the manufacture. "If," asks Mr. Reid, "the sterility of a certain district in Madras is attributable to one single sugar factory, what is to be said of 15,917 saltpetre works and 1,304 refineries, which produce 500,000 cwt. of material for exportation by boiling down the crude substance?" Then there are 87,092 members of the potter caste, who also use no fuel but cow-dung and straw for the baking of all the pots, pans, and tiles used by a population of 7,889,381; while the Kandus and Ghors, to the number of 271,934, who live by the parching of grain, are equally indefatigable gleaners of every leaf they can lay hands on, for the purpose of fuel. Thus, there are 539,540 souls in the province, who make it a business to collect manurial matters for the purpose of burning them. When we remember that not a particle of manure is, or can be imported into the province, the soil of which is annually called upon to produce some seventy-eight million maunds of agricultural produce, much of it of a most exhaustive character, the wonder is that the revolt of Nature against the starvation practised on her, is not still more complete.

Part III. of Mr. Reid's pamphlet gives us his opinion, as to what agriculture in Behar ought to be. Judging from experiments made at his factory, Mr. Reid is confident that every acre of land that now only produces 1,128lbs. of food-grain, can be easily worked up to produce double that quantity. He succeeded in reaping an average of 2,250lbs. of wheat per acre from outside land; and from two crops, one of wheat and one of *makai*, in the same year, he succeeded in harvesting an average of 3,952lbs. of food-grain per acre. No extraordinary expense was incurred to obtain these results, as the crops were reaped from fields that had been previously manured with refuse indigo plant.

With never-ceasing scarcity in the province, and famine threatening on all sides, the subject of increasing the productive powers of the soil one hundred per cent., is deserving of every support from the Government; and Mr. Reid is confident that it is within the power of the planters to bring about these results if supported by Government.

"At present the European planter in Behar," says Mr. Reid, "is working at great disadvantage to himself and the country. The Government look upon him with suspicion; the zemindas only encourages him as a necessary evil, by whose means more money will be extracted as rent; and the poor ryot knows him as a covetous monster, with never-ceasing designs on the best fields of his holding. But this is all the result of the planter not having any recognized position in the country. He is allowed, as it were, to sneak into it on sufferance, and has to make the best terms he can with a grasping set of land-owners. Is it surprising then that he has little inclination to better the condition of the tenants? What is to be expected of a man who holds a village in farm for a term of five or seven years at an exorbitant rental? He would be an angel, indeed, if he went in for improving the property during that short period with the certain knowledge that, if he desired to renew the lease at the end of the term, he would have to pay from twenty-five to fifty per cent. for his own improvements.

If the Government will invite the planter to come in by the front door, instead of allowing him to sneak in by the back, and take him by the hand with a hearty welcome and promise of assistance, then, I am certain, a sounder system will soon be established. Prove to a man that you trust him, and believe him to be capable of better things, and I am certain that he will do his best to show that such confidences have not been misplaced.

Certainly nothing can be worse than the present state of North Behar. The ryots are pursuing a spoliatory system of agriculture, which has already told its own tale in diminished crops and the miserable condition of the masses; moreover, coupled to the wasteful habits of the peasantry, we find that seven per cent. of the entire population are daily engaged in trades, which necessitate the expenditure, as fuel, of enormous quantities of cow-dung and vegetable matter. The proprietors are ignorant and apathetic, knowing little and caring less about their tenants. And the estates are farmed out to *ticcadars* (European and native) for short terms, and at exorbitant rates, with the natural results—the impoverishment of the land and its people.

An effort must be made sooner or later to improve this state of things, and the remedial measures I have to propose are—

1. That the zemindars be advised by the Government to make over the management of their estates to intelligent and practical men, who shall carry out the orders to be introduced for the improvement of the land.
2. That on no account shall a ticca lease be granted at more than the real rental of the village.
3. That a fair and rateable allowance be granted for collecting expenses.
4. Short leases to be disallowed, and no ticcas to be given under fourteen years.
5. All ryots to be granted suitable pottahs.
6. Printed receipts to be given for rents paid, and counterfoils kept.
7. To enable the ryots to tether the cattle in their fields all the year round without fear of getting them stolen, the cattle to be branded with registered marks like the following (S. 1.) The letter represents the first letter of the name of the district, and the number the registered number of the village.
8. If a bullock or cow is sold out of one village to another, the original number to be scored out, and the new number burned in a fresh place so (S. 509.)
9. Descriptions of original marks of new cattle coming to a village to be sent by the putwary, through the chowkidar, to the local police station.
10. Descriptions of all these marks to be circulated to all police stations.
11. Registered descriptions of the marks and numbers of bullocks crossing at the ghâts to be kept by the *ghât ticcadars.*
12. No planter to be allowed to manufacture indigo without a license.
13. Licenses to be granted only to those who are able and willing to carry out the rules framed for the improvement of estates.
14. *Ryottee* indigo to be exclusively cultivated.
15. Indigo fields to be changed at the end of every season.
16. Suitable manure pits to be made at every factory for the reception of *seet*, *seet*-water, and vegetable matter to be supplied by the ryots.
17. Vegetable matter and indigo to be weighed as it comes into the factory.
18. When the vegetable manure is in a fit state to be put on the fields, the equivalent of the raw material supplied by ryots to be made over to them.
19. The planter to see that his ryots strictly carry out the undermentioned orders, which shall be inserted in their *pottahs* for the benefit of the land:—

(*a*) All stalks of oil-seed plants, such as poppy, flax, and mustard, to be taken to the factory, and, after being weighed, thrown into the *seet*-water pit.

(*b*) All leaves of trees in the ryot's holding to be gathered, and sent to the *seet*-water pit.

(*c*) All cattle and buffaloes instead of being tethered in the village to be folded in empty fields for the purpose of conserving the dung and urine.

(*d*) All dung cakes instead of being stacked in the village pathways, or by the side of cess-pools, to be prepared and stacked in the ryot's fields.

(*e*) All ashes and sweepings instead of being carelessly thrown aside or heaped outside the ryot's doors to be daily carried to pits made for the purpose in the ryot's fields.

(*f*) All cattle and buffaloes at the age of one to be burned with the village mark.

(*g*) When cattle are sold, receipts to be given for the price of them.

(*h*) No straw, *boosa*, or stalks to be sold off the land.

(*i*) Rent to be paid in three instalments, *viz.*, in October, December, and April."

He continues :—

> "My proposal for an amendment of the indigo system come to this—that by putting, say, three cottas per beegah of the upland under indigo, and changing every year, the whole area gets a rest from cereals one year in seven, besides receiving a heavy coating of manure from the planter's pit, which will sensibly benefit the land for the next three years. I can safely guarantee that land so treated will give an increase of 100 per cent. produce the first year, fifty per cent. the second year, and twenty-five per cent. the third year. And if all my proposed reforms are introduced, the average outturn will soon show 25 instead of 13 maunds of food-grains per acre. I positively maintain that it is in the land to produce these results ; it only requires assistance in the form of manure."

There is no doubt that the country would be vastly benefitted, if Mr. Reid's proposals could be carried out, but we fear they are not practicable. Where are the ryots to get fuel from, to cook their food if prevented to use cow-dung and other manurial refuse ? Nor would it be desirable or practicable, to sweep such important industries as saltpetre manufacture, and potteries out of the country. Excepting these Utopian proposals, the only other point on which we can find fault with Mr. Reid's pamphlet, is that it omits to notice the great manurial value of the ashes of the manurial substances, used as fuel. We have most conclusive evidence that organic matter in manure, is not an essential necessity to the plant, and that large and larger crops can be obtained by the exclusive use of complete mineral manure, as proved by Mr. Lawes in his lecture at Haddington. Native cultivators appear to have found this out by experience ; for they prefer, for their rice lands for instance, to burn all the vegetable refuse on the fields, and use only the ashes ; and they positively assert that it gives them better results, than were they to plough in the organic matter. Mr. Robertson in his experiments at Sydapet Farm, has also shown the high value of cow-dung ashes as manure ; having increased by the use of 7 cwts. of such ashes per acre, the yield by 40 per cent. We do not ignore the physical improvement of the soil by the use of organic matter in manure, but for the present we should be satisfied if the ashes were but returned and in the meanwhile some more experiments should be made in this country, to place beyond argument whether there is any advantage in using organic matter in manure for the bulk of our crops, or whether the same results cannot be obtained by using a corresponding amount of ashes.

THE CONDITION OF THE MASSES IN BEHAR.

THE last Administration Report of the Bengal Government, calls attention once again to the prosperity of the masses in the eastern districts, fertile districts be it remembered, where soil still yields a profit to the cultivator, being more or less naturally manured by annual inundations. This was well illustrated by the quickness with which the ryots of Backergunge recovered from the effects of the great storm-wave, which swept over their country in October, 1876. It destroyed in one night, most of their crops, all their cattle, and a large section of the population. Close upon it followed a pestilence, which still further reduced their numbers, and it was supposed at the time, broke the spirit of the survivors. Even under the pressure of these unparalleled visitations they did not despair, or appeal to the State for support. A suspension of certain demands, since realized, some small loans, since recovered, and a little private charity, were all the assistance they received. Self-reliant and self-helping, they bore up against misfortune. They rebuilt their houses, imported cattle, and set to work with such zeal that in the next season hardly any difference could be seen in the amount of land under cultivation. They are now once more in the enjoyment of their former prosperity and independence. This is not the first occasion, on which we have had to notice the quickness with which in Eastern Bengal the population recovers unaided from calamity. The same fact was noticed by Sir George Campbell after the flood of 1871, which destroyed the entire crops in parts of Nuddea, Pubna, and Furreedpore. And it may be hoped that the delta of Bengal as a whole will never be a burden on the new famine insurance fund.

In the same Report we find the old complaint as to the miserable state of the labourers and cultivators of Behar. Wages, we are told, "are barely sufficient to furnish the means of life :" they have, in Tirhoot at least, and for field work, "practically remained the same for sixty years." "Although the prices of food-grains have risen, and are still apparently rising, one anna to one anna and-a-half per diem is still the usual wage of an able-bodied labourer." On one anna a day, we may notice, a family man cannot live and pay the salt-tax ; we have made the calculation, and it is impossible. We are also told that they are "under-fed," and this is a necessary inference from the wages, which do not give the means of keeping up healthy life. The cultivators, we are further informed, are generally in debt. "Even in times of plenty, after paying the rent and the numerous cesses exacted by the landlords, very little is left to them for their support." On the occurrence of any local deficiency in the crop in Behar, it become at once necessary to give assistance from public funds, to the great loss of the tax-payers in other parts of India. In 1876-77 there was a slight failure of rice in one sub-division of Tirhoot, and we had at once to adopt measures for famine relief. In the eastern districts, such an event would have cost the State nothing.

The wretched condition of the masses in Behar is the more painful to contemplate, because we have done so much for the advancement of that province. We have given it railways, both the main line and branches, excellent roads in every direction, canals, irrigation. European capital has been largely introduced, and applied with great intelligence, the Behar indigo planters being, beyond dispute, the class in India most nearly corresponding to that of country squires in England. Very large crops of indigo and opium are raised under European supervision. It seems certain then, that this policy of developing the material resources of the country, is not of itself sufficient to raise the condition of the masses, that its vigorous prosecution is consistent with a state of semi-starvation for the majority. And the doubt suggests itself, can it be that this decay of the people, as it has not been prevented, may have been caused by our rule? The immediate cause of the lowness of wages, is evidently the great populousness of the country. The demand for labour is immense, but the supply is greater still, and while this is the case men must necessarily accept employment at starvation rates. Behar is a healthy country, and now that Government has put a stop to the wars and famines which formerly thinned the population, it is one in which the people (who all marry early) must necessarily increase beyond the means of subsistence. For the surplus, there is no choice but death or emigration. At present they seldom emigrate, having the Hindoo objection to crossing the seas or changing the family residence. It is to be hoped that when communication with Assam has been made more easy, they will seek that great field for workers and settlers.

As to the cultivators, the reason assigned for their miserable condition, is the absence of any solid, practical tenant-right in Behar, such as exists in the rest of India, except rack-rented Oudh. Given a country in which there are starvation wages, in the absence of tenant-right there must always be starvation rents as well. Under a system of competition, a cottier-tenant can never, in the long run, get more for his work than any other labourer ; if he did, the rate would be raised. But, we ask, why is there no tenant-right in Behar ? The law there is the same as in Bengal, and the alleged difference is in the administration. The ryot has a legal status, but if he tries to enforce it, he is beaten, or over-matched in the courts. The people are almost paupers, and their pauperism is a burden to the State, because successive officers have failed to protect them in their rights, as defined by the legislature. The principle has been to make everything smooth for the upper-classes, who in Behar have many amiable qualities, and are numerous, and powerful. There has been an habitual leaning to the side of the landlord against the tenant in all disputes, great or small. Government officers when acting in support of the rich, have great power in India, and the result has been, in Behar, the entire prostration of the poor. We are told in the Report, of the prevalence of a practice of illegal distraint throughout North Behar, which we believe, amounted to this; that a landlord would not let his ryots cut their crops until they had satisfied whatever demands he chose to make against them. But how could such a custom grow up in a country in which the scales of justice were held with a firm and an even hand? If persons enter a field in order by violence to prevent a cultivator from doing what he has a right to do, they have committed the offence of criminal trespass; and if they do so in order to make the ryot give them money, they have committed the more serious crime of extortion. For such acts, the Penal Code provides very severe punishments. They can be committed openly and wholesale, only where connived at by the authorities. We have no doubt that the Magistrates in hushing such things up, believe they are acting with discretion, and that they have the good intention of enabling landlords to collect their dues. But this is only one more instance of the mistake of doing evil that good may come, of neglecting duties laid down by law in the hope of thereby keeping the peace, or favouring the settlement of the country by Europeans, or gaining some other plausible object. What we want in Behar is to see justice enforced, to prevent violence by the upper classes. We think that they are diverted to a false scent, who believe that the system of farming the rents, or of enforcing the surrender of a part of the lands of every village for indigo, or any other such isolated practice, is the root of the evil. What is really wrong is, that people in a certain position are allowed to use force to accomplish their ends: having this power, they exercise it in various ways. Such a system is inconsistent with the existence of rights of occupancy, or of any other rights in the cultivator; and now that the administrative staff in Behar is so strong, there can be no excuse for its continuance. We are glad to notice that of late the cousinhood has been in part dispersed, and a new class of administrators introduced, of a school formed in other parts of this Presidency. They may never be able to undo the evil of the past: rights of occupancy once destroyed are not easily revived; but at least we can check the extension of the disease to places which have so far escaped it. And this, perhaps, with the greater effect, if we keep to the simple policy of doing justice between man and man, as cases arise, without fear or favour.

INDEBTEDNESS OF THE INDIAN PEASANTRY.

IN our issue of October last, we published a paper on the Indebtedness of the Indian Peasantry, by Mr. Carnegy, in which he ably, and we think successfully, advocates the gradual establishment of district and sub-divisional banks by Government, to make advances to ryots on the security of tenures and crops at a reasonable rate of interest, say six or eight per cent. The advantages of such a system of Government advances, and the benefits the rural classes would derive therefrom, are fully set forth in Mr. Carnegy's paper and need no recapitulation here. We do not know whether Government has taken under consideration the different proposals which have been made, from time to time, by its own officers, to remedy the existing state of things. Such subjects as the condition of the rural classes are too trifling, we suppose to be worthy the consideration of our Government. It is, however, not improbable that the matter will be taken up in Parliament. Some attention has been drawn to the subject in England by a lecture, delivered on the 13th March last, at the rooms of the East India Association, by Mr. William Wedderburn (Bombay Civil Service), entitled "The Panchayet; a remedy for Agrarian Disorders in India."

Sir GEORGE CAMPBELL, K.C.S.I., M.P., occupied the chair.

Mr. WEDDERBURN addressed an influential meeting as follows:—

If the raiyat is now in a poverty-stricken condition, it is not for want of good intentions on the part of the Indian Administration. [illegible] weak pleading for the indifference with which the Indian Government treats this subject. We all have good intentions.—ED., *I. A.*] Indeed, for several generations of Indian statesmen it has been the special object of Government, shown both in revenue settlements and in general legislation, to make the actual cultivators prosperous and contented: As foreigners, we are aware that our rule must unavoidably be distasteful to certain classes: Those for example who claim the privileges of an aristocracy have lost much of the position and dignity which used to be their birthright; except in Native States they now enjoy little real power. Again, the restless spirits who crave for political and military distinction find their ambition barred by the rigid uniformity of our administration; while the priestly and fanatical classes can bear no good-will towards a Government which, however tolerant, is in their eyes alien and infidel. But we have always trusted that our rule was to be a blessing to the cultivators who form the great mass of the people. If the raiyat—ever industrious, frugal, and docile—was able to maintain his position when pillaged by Moghul, Maharatta, and Pindari, it seemed not unreasonable to hope that he would soon rise to wealth and independence under a Government sincerely desirous of shielding him from every foreign and domestic tyrant. For many years we have maintained a profound general peace; a pure administration of justice has succeeded to wholesale corruption; trade has been opened up; and a fixed moderate land assessment has been substituted for irregular exactions. And what are the results as affecting the well-being of the raiyat? Has he become rich and prosperous? Quite the contrary. From all parts of India the cry is the same. Not only is the raiyat without accumulated resources, but he is sunk in debt. And his daily life is represented to be a hopeless struggle with remorseless creditors, who, by the help of the Civil Courts, strip him at all he has; who take in execution his house, his cattle, and hoe plough, his cooking pots, even his bedding and clothes; who cause his ancestral land to be attached and sold by auction; who can reduce him to serfage, or consign him to a civil gaol. In some districts the state of things has become so unendurable that the cultivators have risen *en masse* to resist their oppressors. Such astonishing results from half a century of peaceful and benevolent Government may well stir us up to ask the reason why. How is it that all our good intentions have failed so utterly? We thought we had been sowing good seed. From whence then has come this great crop of tares?

The problem which these questions suggest is not an easy one. And the solution is further complicated by the irreconcilable difference as to first principles which exists among those who may be regarded as experts. All are agreed that the raiyat is a sick man. It is also manifest to all that the outward and visible sign of his malady is debt; grinding and apparently almost hopeless. But here the agreement ends.

As the matters in controversy are of an intricate kind, I trust I shall be excused if I endeavour to treat them in a somewhat formal manner, stating concisely the case for each side so as to bring out the material issues. The main points for decision are, (1) what is the evil with which we have to deal? (2) what is the remedy? and (3) how should this remedy be applied in practice? In reply to these questions the theory of the dominant revenue party may, I think, be fairly embodied in the three following propositions: (1) that the raiyat's indebtedness to the money-lender is in itself the evil; (2) that if we wish to see the raiyat prosperous we must make him independent of the money-lender; and (3) that it is the duty of Government to interfere directly on his behalf. On the other hand, those who hold the judicial or economic view dissent strongly from each and all of those three propositions. They hold (1) that the raiyat's indebtedness to the money-lender is not an evil if the borrowed money is profitably employed; (2) that the raiyat's natural and healthy condition is one of friendly dependence on the money-lender; and (3) that direct Government interference is contrary to sound principles and will damage those whom it is hoped to serve. Such are the two opposing theories. Which party is in the right? Is it better forcibly to separate the combatants, or to reconcile them?

In order to arrive at a satisfactory judgment on these pleadings, the only safe mode of proceeding is to put aside all preconceived ideas and try to ascertain the real facts about the raiyat in his dealings with the money-lender. We must then consider the economic meaning of these facts, and endeavour to draw conclusions consonant with sound acknowledged principles. Accordingly, I proceed in the first place to consider the raiyat in the concrete. And for purposes of illustration I propose to take the Kunbi of the Bombay Deccan; selecting him partly because in these districts chronic discord between the two classes has recently broken out into open war, and partly because we possess in the five volumes which contain the reports of the Deccan Riots Commission a great body of facts collected on the spot by experienced observers, besides a summary of official correspondence bearing on the subject. In the Bombay Deccan, where the raiyatwari system prevails, the land is usually brought under cultivation through the joint action of the raiyat and the village saukar. The established custom is that the saukar provides the seed-corn and feeds the raiyat and his family until the crop is ripe; making also cash advance to pay revenue in instalments, buy bullocks, dig wells, and so forth. When therefore things work smoothly, the condition of the two classes may be regarded as a partnership founded on equity and mutual advantage; each taking a share of the crop which is produced by the industry of the one and the self-restraint of the other. In a few cases, perhaps, the raiyat is independent of the saukar, having by him sufficient capital for maintenance and improvements. But such cases are not common. For the enterprising raiyat who has good credit likes to extend his cultivation and raise more valuable crops, such as sugarcane and spices, taking up capital to be afterwards repaid from the increased profits of his land. And in any case he finds it convenient to have a running account with the saukar who is a general dealer as well as the village banker. Speaking of the old friendly relations of the two classes, Captian (now Sir George) Wingate, in a report to the Sadar Adalat, tells us that "the village money-lender and the raiyat worked together in harmony, and both alike shared prosperity and adversity together." That this is the raiyat's view of the natural order of things is amply shown by the evidence taken before the Commission. Thus one witness describes how, when hard pressed, he appealed to his creditor on the ground of this natural tie, and besought him saying: "You are my mother and I am your son," and in truth the parable is not inapt. For the saukar's advances are to the raiyat as mother's milk. He cannot live without them. And all that he asks is to be treated with parental kindness and forbearance. This view, which recognizes the mutual dependence of the two classes and regards reconciliation as the only hope of future prosperity, is strongly urged by Mr. Shambhuprasad, a very experienced Native member of the Commission, who summarizes his conclusions as follows:—"The raiyats cannot do without the saukars: they must have some people to borrow from, and Government cannot undertake the business of the saukars. No measure should therefore be taken that may disturb the amicable relation between the saukars and the raiyats.' The saukar is, as it were, the channel of irrigation. Without him the raiyat must remain unproductive, like fertile soil when the water-supply is cut off. If this be accepted as a correct description of the natural relationship, how should these facts be expressed in the language of political economy? We know that all circumstances attending the production and distribution of wealth are capable of being analyzed according to scientific rules. To what class then of phenomena should we refer the original friendliness and the present internecine struggle between those who borrow and those who lend? It appears to me clear that in the existing disorders we have simply a repetition, in an Indian form, of the great struggle between the labourer on the capitalist: on the one side the raiyat who represents labour, on other side the village saukar who represents capital. It is true that in Europe the rate of wages is outwardly the matter in dispute, while in India it is the rate of interest. But the principle is the same. And as soon as we can fully realize this important fact the whole situation will become clear. For the conclusions of political science will be available to us for guidance, teaching us to trace effects to valid ascertained causes. Thus in the present case the text-books on political economy set forth the ordinary incidents of a contest between labour and capital, showing in what respects the interest of the labourer is identical with that of the capitalist and in what respects it is antagonistic. And these incidents are equally true in India and in England. To put the case in its simplest form, when the labourer and the capitalist jointly produce a loaf, it is the interest of both that the loaf should be as large as possible. This is the first and harmonious stage. But their interests become antagonistic when, at the second stage, each desires to secure for himself as large a share of the bread as he can. They are not wishing the joint profits to be large, but they fall out as to the terms of the partition. The ruinous evils of such a quarrel are being amply illustrated in England at the present time. But no one supposes that any industry would be benefited if the connection between capital and labour were to cease. Nor does any one suppose that good would come from direct interference by the Legislature in favour of one or other of the combatants. On all hands it is acknowledged that the only remedy is to be found in reconciliation so as to produce harmonious and efficient work at the stage of production, and an equitable and easy decision in allotting the profits. Similarly in India the parties have passed from the first stage, when "the village money-lender and the raiyat worked together in harmony," to the second stage of mutual hatred and mutual injuries. And similarly it will be found that the only valid remedy is reconciliation, according as it does equally with the principles of political economy and with practical experience as set forth by Mr. Sambhuprasad.

Having thus briefly reviewed the situation of the raiyat, and pointed out its economic aspects, we may now return to three propositions which seem to embody the idea of those advisers of Government who favour the revenue or paternal theory of treatment. The propositions are as follows: (1) That the raiyat's indebtedness to the saukar is in itself an evil; (2) that if we wish to see him prosperous we must make him independent of the saukar; and (3) that it is the duty of Government to interfere directly on his behalf. Judging by the conclusions we have just arrived at, we shall find that all these propositions are founded either upon misconceptions of fact, or upon erroneous principles. First, then, is the indebtedness of the raiyat to the saukar an evil in itself? On this point there is much confusion of ideas. Because excessive debt appears before us as the main sign and symptom of the cultivator's ruin, many of his friends run away with the notion that debt is the evil we wish to get rid of. They mistake the symptom of the disease for the disease itself. But a little consideration will show us that debt is not in itself a bad thing. On the contrary, if a man can borrow money at 12 per cent. and make 50 per cent. by employing it in cultivation or any other industry, the debt is a source of prosperity. The deeper he can plunge into debt on these terms, the greater will be his profits. Considered in this light, debt is simply working on borrowed capital; the method followed by all enterprising classes of producers, such as the mill-owners of Lancashire and the tenant farmers of Scotland. It would be absurd to suppose that debt of this kind took anything from a man's position and independence. We see therefore that debt is good or bad, profitable or burdensome, according to circumstances. The borrower is prosperous if the profits of his business largely exceed the interest he pays for his borrowed capital. But if the interest more than eats up the profits, he is evidently tending to ruin. We thus see that the test question for schemes of relief in favour of the embarrassed producer is whether they tend to reduce or to increase the rate of interest which he has to pay. All measures which improve the raiyat's credit and reduce the rate of interest by drawing capital to the land must be approved, while those must be condemned which damage the raiyat's credit and prevent his borrowing on favourable terms. This conclusion, which is the key of the whole position, brings us face to face with what appears to me perhaps the most dangerous, because the most plausible, fallacy by which the right understanding of this question is obscured. I refer to the doctrine of those advocates of the paternal theory who hold that, although we cannot do away with the money-lender altogether, it is desirable to diminish up to a certain point the raiyat's facility for borrowing. They admit that it would not do to destroy his credit altogether, as they see that if the saukar refused to feed him till his crop was ripe, the land would simply go out of cultivation. But they hold that it is bad for the raiyat to have too much credit, as that will probably lead him into extravagance. They think that by judiciously tightening the money-market, supplies may be stopped at the point where necessity ends and extravagance begins. With reference to this idea it may be noted that the inquiries of the Deccan Riots Commission show that the supposed extravagance of the raiyat, his expenditure on marriage and other festivals, has been altogether overestimated. To quote their words:—"The occasions occur seldom, and probably in a course of years the total sum spent in this way by any raiyat is not larger than a man in his position is justified in spending on social and domestic pleasures." But in point of fact the whole doctrine is a fallacious one, being founded on the supposition that the power of borrowing depends in any way on the purpose for which the money is borrowed. The power of borrowing depends on the credit of the borrower—and upon nothing else. The money-lender is no *custos morum*; and will lend Rs. 100 to A for a caste dinner with illuminations and fireworks, while he will not lend one rupee to B to keep him from starving. Moreover, by tightening the money-market we do not cause loans to be refused, unless it be to a few of the most destitute; we only raise the rate of interest all round, and embarrass those who might otherwise conduct their business at a profit. An illustration will show the mischievous effect of such a policy. Suppose A, B, and C cultivating three portions of a field, which yields 50 per cent. on the outlay. A having good credit borrows at 12 per cent., and is prosperous: B borrows at 24 per cent., and maintains himself comfortably; while C has to pay 36 per cent., and lives on the verge of subsistence. If the money-market be tightened to the extent of 12 per cent., who is benefited? The result is that A's prosperity is gone, B is reduced to a bare subsistence, and C is ruined. As the flood deepens, those who had their heads above water are brought into difficulty, and those who were struggling are drowned altogether. Or we may put the illustration in a different form. Suppose the interest to be the same for A, B, and C, *viz.*, at 24 per cent., and suppose the productiveness of their land to be the varying quantity, A's land producing 50 per cent., B's 40, and C's 30. It is evident that if the rate of interest be reduced to 12 per cent., not only would all three be largely benefited, but they could profitably extend their cultivation to lands of inferior fertility; while, on the other hand, if the rate of interest were raised 12 per cent., the profits of A and B would be reduced, and C's land would be thrown out of cultivation altogether. I think these considerations are sufficient to put out of court the doctrine that the raiyat can be benefited by tightening the money-market. We thus return to the conclusion above arrived at, that schemes of relief must be approved or condemned according as they tend to reduce or to increase the rate of interest, that is, according as they improve or damage the raiyat's credit. And upon the issue stated in Proposition (1) we find that debt is not necessarily a bad thing, on the contrary it tends to prosperity if the raiyat's credit is good enough to allow him to borrow on favourable terms. The Guzerat cultivator who has good credit pays 12, 9, and sometimes only 5 cent. per annum interest, and is prosperous enough. It is the unfortunate bankrupt Deccan raiyat who is crushed by his load of debt, because he is charged from one pice to one anna per rupee per mensem, that is, from 18¾ to 75 per cent. per annum.

We now come to the second proposition, and inquire whether, in order to help the raiyat, we should try to make him independent of the money-lender? There are many in India who think that the raiyat's connection with the saukar should, if possible, be broken off. They regard the money-lender as the natural enemy of the cultivator, as the evil spirit which lures him into debt, and ultimately sweeps him away into perdition. This feeling of hostility to the money lender, though not altogether unnatural, is most unfortunate. It originates no doubt partly from the fraud and cruelty practised by individual creditors. But it may also in great measure be traced to a false analogy drawn from experience of things as found in England. Lord Cornwallis in his permanent settlement of Lower Bengal was probably to a certain extent misled in his calculations by identifying the zemindar with the English landlord. And it appears that a similar fallacy underlies most of the popular schemes for relieving the land-holdings class of Western India. The raiyat in debt to the saukar has been too much identified with the prodigal heir of English or Irish estate caught in the foils of the wily usurer. And accordingly throughout the official correspondence we find the money-lender condemned in the bitterest terms. He is represented as battening and fattening on his victim. He is the "village Shylock," the "vampire," the "blood sucking bania." The image thus brought before our mind's eye is that of a poor struggling human being upon whose throat some foul creature has fastened; and the by-standers are appealed to to put an end to so horrible a scene. Who can be so heartless as to watch such a struggled unmoved? Must we not smite the monster and tear him from his prey? Now the whole of this is made up of ill-directed sentiment and is based on a false analogy. If we must needs have a grotesque simile, I would rather liken the raiyat and the saukar to the Siamese twins, who could quarrel and inflict blows on each other, but whose comfort lay in harmony, and to whom separation meant death. But in truth it is better, in so delicate analysis, to rid ourselves of such analogies which are apt to prove misleading. The only proper method is to examine the dry facts and accept the results of political science. And by applying this method we have already shown that to separate the raiyat from the saukar is to separate labour and capital and to cause the ruin of both. With reference, therefore, to Proposition (2) we must decide that it is neither possible nor desirable to make the raiyat independent of the saukar; that the great object is to reconcile the two classes and set them to work together in harmony. If this be the case, it is evident that all angry feelings expressed against the money-lender tend only to mischief. Throughout history the money-lender has never been a popular character; and it is only too easy to arouse irrational feelings of hatred against this useful public agent whose abstinence and industry accumulate and distribute the wages fund. Moreover, when we look calmly at the facts, there seems to be no reason to dislike the village saukar, who, according to his lights, maintains a hard struggle for existence. The Commissioners have stated in their report that "there is no evidence before (them) that the profits of the saukar's business are extravagant." And my own experience is that the village Marwari, so far from being swollen with gains, is often the most ill-fed and ill-clothed member of the community. He is ever on the tramp, enduring much obloquy and ill-treatment. And I am informed that he usually has to serve an apprenticeship of some twelve or fifteen years before he can afford to marry and set up on his own account.

With regard to Proposition (3) no detailed argument seems to be required, seeing that we merely state a commonplace when we condemn Government interference in disputes between labour and capital. I shall therefore simply sum up my conclusions as regards the three propositions above stated, and claim a verdict against the revenue or paternal theory of treatment on the ground that it has been shown (1) that the raiyat's indebtedness is not an evil in itself, but that it may be made advantageous to him if we can so improve his credit as to enable him to borrow on terms which will make industry profitable; (2) that the raiyat's natural and healthy condition is one of friendly dependence on the money-lender, and that this connection, instead of being dissolved, should be regulated and developed; and (3) that all attempts at direct interference on the part of Government in favour of either party are contrary to sound principles, and will only damage those whom it is hoped to serve. Any measures of severity directed against the lending class, any difficulties thrown in the way of their business, will only injure the borrower. For if the partnership be dissolved, the raiyat is left helpless, whereas the saukar can remove his capital and ply his trade elsewhere.

Gathering up these conclusions into a simple formula, we thus find that, instead of being a misfortune, the raiyat's connection with the village saukar may be made the foundation of general prosperity. But this happy result depends on the fulfilment of three important conditions; there must be good-will and confidence between the classes; the rate of interest must be moderate; and there must be some reasonable safeguards against oppression. On these terms the more capital that flows towards the land, the better. Accordingly the leading remedies for existing anarchy and pauperism appear to be the following:—

(a) *Conciliation*, to heal the quarrel between the classes;
(b) *Improved credit*, to lower the rate of interest; and
(c) *A law of insolvency*, to provide a means of escape in extreme cases.

We cannot spare sufficient space to give the lecture in full, but Mr. Wedderburn advocates the establishment of "panchayets," to settle money disputes between borrower and lender, and so do away to a great extent with expensive court proceedings, which ruin both lender and borrower. Though Mr. Wedderburn does not seem to be much in favour of agrarian banks, he has said much to strengthen Mr. Carnegy's hands, and we ourselves are of opinion that any successful action of Government in the matter must lie in the direction, Mr. Carnegy has pointed out.

THE HARVEST IN THE NORTH-WEST.

THE spring harvest may now be said to be over throughout the whole of the North-Western Provinces, and we are able to estimate its value, both as compared with the harvests of previous years, and as a means of relief to the people in this particular year of scarcity and suffering. It is its efficiency in relieving distress which is more immediately important, and there is some satisfaction in knowing that in this respect the harvest has done its office well, though hard times will soon come again. No sooner were the crops ripe, than a general exodus from poor-houses and relief-works began. The people were confident of present employment; they thought they foresaw cheap food in the future; and so they renounced the State aid which they had accepted only in the last resort, and started off to shift for themselves. In the Bareilly poor-houses, for instance, the tale of inmates fell in a few days from nearly 5,000 to little more than 500, while all the relief-works in the district expired of inanition. Nothing could more forcibly illustrate the direct and absolute dependence of whole classes of our Indian population upon the half-yearly tribute of the fields. It is as though the people were on rations, like the garrison of a beleagured town. If a harvest fails, partly or altogether, the country is imperfectly provisioned for six months, and all the lower classes are put on short allowance till the siege is raised, and the next convoy of relief arrives with its stores calculated to last over another six-monthly period. Six weeks ago, the poorer people were in actual danger of starvation, a danger which in the case of too many turned out to be a terrible reality; and the measures of relief undertaken by the Government were absolutely necessary to save life. These measures were behind-hand and imperfect, owing partly, it may be, to the peculiar circumstances of the case. The people knew that relief was near at hand, that the new food supplies were on the point of coming in, and there was not that readiness to seek assistance from the State which would undoubtedly have manifested itself had the prospect of the harvest been more distant. This feeling was reciprocated on the part of the Government by an attitude which, if not exactly one of unwillingness to help, was certainly not inspired by any ardent zeal for discovering and remedying the lamentable condition into which a considerable proportion of the agricultural population had sunk. All this, however, is over for the present. The police have ceased to find dead bodies by the wayside and in the fields. One hears no more complaints of starvation in the villages. Past sufferings have, for the moment, been eclipsed by the comparative ease of the present. Harvesting is always cheerful labour, and this harvest is the more welcome because it is much needed, and has been long expected in anxiety and privation. The countryman has gained heart again, and there is an air of contentment and hopefulness about the villages to which they have been strangers for many months.

Nevertheless, these rejoicings are dashed a little with regret. The harvest has been good, but it has not fulfilled the expectations which at one time were entertained of it. Some of these were mistaken from the first, and others have been disappointed by mischance. Thus, it was generally supposed—though we doubt if the cultivators themselves shared in the error—that the failure of the autumn crops was in a way favourable to the spring harvest, because the unproductive fields could be brought under the plough a second time and sown with cereals after the millets and rice and cane had perished. But it was obvious that the success of such an experiment would depend greatly upon the nature of the land. The fields had been required to supply nourishment to the autumn sowings, abortive though they were, and it might safely be inferred that in most cases they could not undertake a spring crop also without risk of exhaustion. How far the double sowings will prejudice this year's *khurreef* yet remains to be seen; but we know that they have not generally yielded very ample results in the *rubbee.* A secondary consideration, but one by no means unimportant, is the fact that a large proportion of the autumn fields were destined for rice, and land prepared for rice should be completely broken up before admitting any other crop. This change the cultivators either had not the time or means of making, or, as is more likely, they abstained from doing so, knowing that the fields must revert to their proper use a few months after; so the flax or barley was thrown into the small rectangular fields, laid out expressly for the purpose of holding water, and there left to take its chance. Without rain, or with rain in moderation, that chance would not have been so bad; but the unusually heavy rainfall of the late autumn and the winter, duly caught and retained in fields meant for a water-loving crop, wrought extensive damage among these spring trespassers on autumn ground, especially the flax which was generally smitten with mildew. The large area under flax, indeed, was a remarkable feature of the late harvest. It is partly to be explained by the growing demand for flax seed from India, and the encouragement of this species of cultivation by the large exports of last year. Possibly the growth of flax may hereafter take a still more important place among Indian agricultural industries. Private enterprise in Calcutta has begun to deal with the fibre as well as the seed, and has succeeded in attracting official attention to the prospect of a new manufacturing staple, to be prepared in the way described in a little pamphlet circulated among district officers. No doubt the matter will be taken up by the Agricultural departments at Simla and in the provinces; but it is from unofficial energy and speculation that we must expect results. At present this much can be said with confidence, that Indian flax as now grown would furnish a very inferior fibre. There has been abundant occasion of satisfying oneself of this during the past winter. In many villages of Rohilkhund and Oudh almost the entire cultivable area, broadly speaking, was under two crops—wheat and flax, the former often mixed with barley, and the latter with vetches. The wheat was magnificent, except where the soil was decidedly poor; but the flax, on the finest soil, made a very sorry show. Short in stalk, thin in fibre, laden with a superabundance of flower, it presented most of the characteristics which the flax-grower desires to avoid. The fields, as we said before, were in fault; not because they were naturally unproductive, but because they were meant for a crop presenting in some respects the exact reverse of the crop which was actually sown in them. To aggravate these shortcomings, the flax was almost everywhere more or less covered with a red mildew, clothing it so thickly that the boots of the *sahib*, striding over the fields on sport or duty, soon assumed a bright orange hue, to be retained for the rest of the day. This was the effect of too much water. There is some comfort in knowing that the loss to the cultivator has not been so great as if a similar calamity had befallen a more costly crop. Flax seed is cheap, and was, in fact, chosen for its cheapness; though by the irony of fortune it happened to be less cheap than usual last year.

But besides this disappointment, which might have been foreseen, there have been other causes hostile to the spring harvest, which were beyond the reach of human anticipation. Over a large area, the wheat has suffered from untimely winds which have prevented the ears from filling out into their proper plumpness. The injury is greatest where the crop was naturally poorest, and possessed of less native vigour to stand the trial. Then, two principle food-staples of the poorer classes have turned out unsatisfactorily for reasons unknown. The *urhur* has somehow come to grief. There was a great show of flower, but the pods are not so full as they should be, and in many places they have never filled at all. Much the same is the case with the gram and its kindred vetches. There are plenty of pods, but they contain nothing, exploding with a derisive pop when pressed to yield up the grain which they profess to hold. These are, no doubt, among the imperfections incident to every harvest, though they are especially to be deplored in the present circumstances; but nobody can deny that the cultivator has just reason to complain of the hail-storms which have chosen this year, of all others, to lay waste his fields. In several districts of the Agra and Rohilkhund divisons, the damage done by hail has been quite extensive enough to make an appreciable difference in the situation till the next autumn harvest. The loss is, indeed, limited to certain localities, and is not general, like the loss from drought; but those localities are sufficiently numerous to claim attention, as signifying increased distress among a noticeable proportion of the district population. The smitten villages will of course share in the general relief afforded by the new food supplies, though their own food supplies have been lost; but the payment of debts and the re-furnishing of households, must now be postponed till the autumn, and the people must hold out till then on less food than their neighbours. The economical consequences of these hail-storms—they happened on the 10th of February and the 16th of March—are so unhappy for hundreds of villages, that one is almost ashamed to regard such a calamity with a scientific eye. Still, it is not uninteresting to note, first, that the showers, for the most part, appear to have fallen altogether according to caprice, instead of moving along definite lines, as hail is usually supposed to do; and, second, that comparatively small hail-stones, falling thickly, are much more destructive than huge lumps of ice dealt out in more moderate measure. It is the frequency, not the size, of the pitted marks on the fields, by which the amount of ruin may be conjectured. Judging by these marks, the hail-stones in some places must have been marvellously large, and one can almost acquit the cultivator of exaggeration when he affirms that the biggest of them were of a size to fill the hand and that men caught in the fields had to fly under trees for shelter, and hold their folded blankets as a roof above their heads. The loss was partly redeemed by the second sprouting of the barley, destroyed in February, and by the possibility of gathering the ripe ears cut off by the showers of March; but the compensation in neither case was considerable. On the whole, it is a matter of thankfulness that the harvest has been got in at last; but it will not make good the losses of the autumn, nor save the people from hard times for the next six months to come.

COTTON CULTIVATION IN THE PUNJAB.

Report for the year ending 30th June 1877.

THE area reported last year as under cotton was 698,893 acres. The area in 1876-77 was 686,716 acres. There was an increase in the Rawul Pindee division, and a decrease in the Mooltan division. In other divisions, the area was about the same. Of the total area, 384,220 are returned as irrigated, and 302,496 as unirrigated. In the Mooltan division the cotton crop is raised almost entirely on irrigated, usually canal-irrigated, land. This is also the case in the Dera Ghazi Khan district, where the inundation canals from the Indus irrigate a large area. In the districts of Delhi, Gurgaon, Rohtak, and Gurdaspur, though part of the area is watered by the canals, there is a large proportion shown as unirrigated. In Shahpore the crop is largely grown on the inundation canals. In the rest of the Rawul Pindee division the crop is dependent on rain. The total outturn is estimated at 529,011 cwts., as compared with 436,904 cwts. last year. The average yield is 86lbs. of cleaned cotton per acre. In some districts the rate of yield is probably stated too high in the returns. The total value of the crop is estimated at Rs. 1,02,35,930, which is considerably more than last year, owing to the rise in price and the estimated increase in yield. Where the yield is anything over 50lbs. per acre, and the cost of cultivation is under Rs. 9 per acre, there is a bare margin of profit; and in most cases the yield is much higher and the cost of production much lower than this, so that the crop is ordinarily a profitable one. It is, however, exposed to occasional risk, from failure of rain, or from unseasonable rain, and from the attacks of insects. The local reports show that upon the whole the past season was a favorable one. No experiments worthy of mention were made with exotic seed, except that in Dera Ghazi Khan a few ounces of American seed were sown and the plants promised well. Upon the whole the trials of new seed and new modes of cultivation have not succeeded in the Punjab, and have not made any appreciable impression on the minds of cotton growers, who are apparently satisfied with indigenous seed and the modes of cultivation to which they are habituated. The place where experiments held the best chance of success was the Amritsar Model Farm, where during the year seed from the Central Provinces and Dharwar, and also the Nankeen variety, were tried. The Dharwar plants gave good promise and yielded a fine quality of fibre, but the frost killed most of them. The Central Provinces seed did not do well. The plants from indigenous seed throve well until the winter frost killed them. The value of the fibre produced was estimated at over Rs. 20 per acre, the average cost of cultivation being calculated to be Rs. 9-10-8 per acre. The Amritsar Farm is now closed, in accordance with orders of Government, and the experiments with Hinganghat seed in the Rawul Pindee district have been discontinued. In the Punjab, it appears from the report, the area under cotton does not vary greatly from year to year, and forms only about 3 per cent. of the total area under cultivation; whereas, for instance, wheat, the principal food-grain, takes up an area of 30 per cent., and other food-grains in proportion.

THE NAGPORE MODEL FARM.

FROM the last Central Provinces Administration Report, it appears that the Nagpore Model Farm, which occupies 161 acres, has had a very successful year. It is worked in three divisions: one (14 acres) being devoted to experimental cultivation, another (16 acres) to fodder culture, and the third (307 acres) to the production of the ordinary crops of the country on a commercial basis. In cultivating ordinary crops the utility of the farm as a model, conveying practical lessons to the agricultural classes, depends on its being clearly demonstrated that the improved modes of culture adopted pay. Irrigation and proper manuring are troublesome and expensive processes, but if it can be shown as regards the ordinary staples that when applied they enormously enhanced the yield, it may be hoped that slowly enterprising cultivators in the neighbourhood may imitate the methods which they see are so successful, and in this way high cultivation may take some root. The results of manuring and irrigating in increasing the wheat outturn are very striking. In the Nagpore country the average wheat yield per acre is 400 lb. (5 maunds) from sowing 50 lb of seed; while on the Model Farm, where the sowings were at the rate of only 40 lb. per acre, the following markedly high outturn was obtained in the best fields :—

Jelalia wheat	... 1,600 lb., or 19½ maunds	per acre (26⅔ bushels)
White-eared wheat	... 2,200 lb., or 26¾ maunds	per acre (36⅔ bushels)

Samples of the above, the Chief Commissioner is informed, were sent to Messrs. Stearns, Hobart and Co., wheat exporters, Bombay, who pronounced the white-eared samples to be "beautiful wheat," and added "we have never seen a quality to equal it in India." Such wheat it is noted would take a high price in Liverpool, *viz.* 12*s.* 3d. per 100 lb.; and in Bombay it would average Rs. 30 per candy,* or over Rs. 3 a maund. At Nagpore itself, therefore, the produce value of the acre would never be lower than Rs. 60; and as the cost of this high cultivation, including all expenses, is given at Rs. 10 per acre, the profits to a cultivator would be very large. The instance is a striking one, showing the advantages of high cultivation.

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* 756lbs.

The ordinary cultivation of cotton gave an average yield of 102 lb. of cleaned cotton per acre, being well over the ordinary outturn of the district. This resulted from proper weeding and ploughing, and the careful selection of seed, but without recourse to manure or irrigation. The advantages, however, of high cultivation in increasing the outturn is shown by the yield in the manured and irrigated experimental field, which gave the unprecedentedly high local return of 326 lb. clean cotton per acre. The Model Farm, it would therefore appear, has now made a fair start, and the results of manuring and irrigation, on a considerable scale, of lands, which at first were far below the average of Nagpore lands in fertility, cannot fail most favourably to impress cultivators who have any capital and spirit of enterprise.

Commenting on these facts, the Secretary of State desires to be informed what steps are being taken in the Nagpore and other provinces to communicate these results to the agricultural community generally. As in many cases these model farms appear to involve financial loss, it is important that such results as those given above should be made known as widely as possible.

EDITORIAL NOTES.

We would draw the attention of our readers interested in cotton and its cultivation, to the report presented to the Egyptian Minister of Agriculture by M. Delchevalerie on the Bahmieh cotton plant, of which we have given particulars in several of our issues. The report will be found elsewhere.

The Famine Commission, as finally arranged, is as follows :—General Strachey, President, Mr. Elliott, C.S., of the North-West Provinces, Secretary; Members—Mr. Caird; The Honourable Mr. Justice Cunningham, of the Calcutta High Court; Messrs. Ballard Madras C.S.; Batten, Bengal C.S.; Peile, Political Agent, Kattywar; Rungacharlu, Controller of the Palace at Mysore; and the Kharbaree of Kholapoor.

After writing the first of our leading articles in which we repeat the complaint we so often make about the delay which occurs before papers of purely agricultural interest reach us, we read with great pleasure the following announcement by Government in the official *Gazette* :—

"*Government Experimental Farms.*"

"The annual reports which are now prepared, on the results of the experiments conducted at the Government farms, are mostly issued so long after the end of the period to which they relate, that much of their interest is lost before they reach the public. Arrangements have now been made for the preparation of reports at more frequent intervals, and in most cases monthly reports will be made. These will be published on receipt in the Supplement to the *Gazette of India.*"

We thank Government for the concession it has made to the interests of the agricultural public, and we can assure it that the usefulness of these farms will be greatly increased by keeping the public *au fait* to the experiments that are being made and their progress.

These monthly reports will make the agricultural public take an interest in what is going on, and enable us to criticize the work of the different Superintendents. The first series of these reports has reached us, and will be published by us next month. We are sorry to miss from this first series reports from the Madras farms, superintended by Mr. Robertson, and trust that these will also be forthcoming. We shall have occasion to refer to them in our next issue.

The Madras Government is endeavouring to trace the causes, which have produced the legions of locusts, and other insect pests, that have been and are still damaging the crops, to a considerable extent. Some of the locusts have been identified by Dr. Bidie, as belonging to the sub-order *Heteroptera*, and the genus *Leptocorisa* of *Latreille.* The group is a very large one, and this species, as well as most of the others belonging to it, lives on the juice of plants. Dr. Short has undertaken to investigate the matter, and specimens of insects are, in future, to be forwarded to him. We believe no practical results can attend these investigations, though in the interests of science, and especially of entomology, they deserve every encouragement. Widely-spread visitations of blight and insect pests, such as we are witnessing in the Madras Presidency, are dependent upon climatic influences and unseasonable weather, which favours their development.

In Southern Russia the peasants predict the appearance of locusts in large numbers, years beforehand, with unfailing certainty, and they assert that there exists a cycle of locusts, dependent no doubt, upon a cycle of wet and dry seasons. The energies of the Madras Government should now be directed to the import of sound seed for distribution to the ryots, and we trust this matter, to which we also referred in our last issue, will receive the earnest attention of the authorities.

Our Southern contemporaries are alarming themselves and the agricultural public, by suggesting the possibility that these uninvited guests may propagate and establish themselves permanently in Southern India. We believe there is no ground for these alarms; locusts have never been known to propagate successfully while on the wing, or to establish themselves permanently in any of the localities, over which their migratory course takes them. All the evidence we possess on the subject, seems to show that these insects multiply to an alarming extent only, under peculiar climatic circumstances. However, it will be well for Government to put itself in possession of all the facts bearing upon the subject, and the latest information will be obtainable from a report of the United States Entomological Commission, which we believe was published last month. Some two or three years ago, a great part of America was overrun with swarms of locusts, and the above Commission was appointed to enquire into the causes of their sudden appearance. and report upon any measures which might be suggested by members of the Commission or the public, to control the spread of this plague. This report should now be available.

Mr. Robertson in his report on the blight called "smut" (*Uredo segetum*), a fungoid disease, which has attacked extensively the cholum in the Madras Presidency, states it as his opinion that the ill-health of the plant is a necessary condition for the full development of the blight, and that this ill-health is due to insufficient cultivation and unseasonable weather. The blight will pass from one field to another. Attempts, therefore, to eradicate it must extend over districts. Seed from blighted plants will reproduce the blight in the following crop, which can, however, be prevented by chemical dressings, of which the following has been the most successful :—

"For 50lbs. of seed take 3 ounces of sulphate of copper, which dissolve in one quart of hot water; when the solution is quite cold, pour it over the seed, with which mix it thoroughly; when quite dry, the seed is fit for sowing."

Referring to the swarms of caterpillars and other larvæ of insects which have attacked the young paddy, Mr. Robertson has found, that the crops which have suffered most from insects are generally in an unhealthy state, and that the damage the crops have received is not yet extensive. He is of opinion that unless heavy rain occurs soon, both damaged and undamaged crops are likely to suffer severely from these insects; that the chief of the causes that are operating to the hurt of the young crop could be controlled if there was an abundant supply of irrigation water available; and that, if it is found after proper inquiry that there is not sufficient irrigation water available for bringing to maturity the whole of the young crop, inducements should be offered to ryots to plough up the worst of the young crop and substitute for it raggy.

The Madras correspondent of the *Pioneer* remarks in a recent letter :—"It is doubtful if very deep moving the soil is desirable where rain seldom falls. Unquestionably a good bed, say 9 to 10 inches deep, will grow things better than a shallow one, if you can keep the deep bed damp; but where solar radiation is so great as it is in India, the evaporation is much more rapid where the soil has all been moved, than where it has been moved only reasonably, as the natives of India are accustomed to do it." We need not say that this argument is incorrect, and contrary to established facts. The deeper the soil is moved, and the more it is pulverised, the better will it preserve moisture and prevent it being lost by evaporation. The roots of plants, in deeply cultivated soils, go far below the surface into a stratum which is, so to say, shaded by the upper layer of the soil, and which is thus effectually protected from the evaporation influence of sun and wind.

The Governor of Goa seems to be determined, to find the money somewhere for introducing improvements upon the native system of agriculture, to which the attention of the local Government has been directed by instructions from Portugal. The Governor has compelled the village communities, notwithstanding their protest, to pay forthwith a large sum of money to defray the cost of an experimental agricultural farm, and has likewise ordered several churches at Goa to contribute annually, from their private funds. When the law establishing this farm was passed, it was provided that its expenses should be met by the public treasury, and not by the village communities, whom His Excellency now wishes to saddle with the cost of it. The *Patria*, *Gazeta de Bardez*, and the *Ultramar* have denounced this act of the Governor ; and from the same source we learn, that without caring to wait for the arrival from Portugal of the practical agriculturist who is to work the farm, and who by the way has not yet been appointed, His Excellency has selected a site for it in Old Goa, a place that has been deserted for many years as being very malarious and prejudicial to health.

Prosecutions under the Adulteration of Seeds Act have occasioned no little excitement in the seed trade of England. The Act was passed in 1869, but until lately had not been enforced, probably because of the difficulty of getting evidence where everything is so secretly transacted. No doubt our readers know, that there is a great similarity in appearance between the seeds of several varieties of the brassica tribe, whilst there is much difference in their market value. Rape, for example, is a low-priced seed, and may be passed off for Swede or cauliflower, or by using a sieve of suitable mesh, a fair sample of cabbage seed may be obtained from it. Rape, therefore, is often used to adulterate the more expensive kinds, but it is an essential condition that seed so used shall not grow. The practice of "killing' such seed has, therefore, been adopted as a trade by certain rogues, who sell the killed seed to certain roguish seedsmen, who endeavour to push a trade by underselling rival firms. Seed that is too old to grow is of course, also used for adulterating new seed, and the fraud of mixing old seed with new is not less, than when "killed" seed is so employed. The actions recently taken have been got up by certain respectable seed firms, who have long suffered loss of trade from the unfair competition of those who buy this killed seed. It is obvious that no honest dealer can compete with those who sell samples containing 50 per cent. and upwards of dead seeds. Farmers who go for the lowest priced article, irrespective of quality, are primarily to blame for those frauds. If each farmer tested the samples before buying them, and thus determined what percentage of the seed was true to name, the trade of the adulterator would be at an end. Nothing is more easily done than testing the growing percentage. A saucer, a little sand and a bit of flannel kept moist will in a few days show how many seeds out of 100 sown are alive. The doctoring of clover seed forms part of the business of the adulterator or killer. Seed that is too old to grow is coloured according to the use intended. One variety is sometimes to be mixed with another, whose seeds it resembles in form but not in colour ; when only old seed, say of white clover, has to be mixed with new, the process of removing its appearance has alone to be performed. Lucerne seed is sometimes adulterated with killed trefoil of certain kinds, or with other medicagos, which are no better than weeds. It is gratifying to English farmers to know that the prosecution of the person, who sold killed charlock seed, resulted in his conviction, as did also a prosecution for adulterating Alsike clover, although another clover case was lost through a defect in the Act, which is promised to be remedied next Session. But if rogues are hindered from selling bad seeds in England, the colonial markets are still open to them, and we may depend upon their improving the opportunity to the fullest extent. We would therefore warn our readers from purchasing from any but well-known and respectable firms.

The cotton harvest in the Berars in now over, and the damage done to the crop by the unusual rain last year, has been estimated at three-sixteenths totally destroyed, and about one-fourth depreciated in quality.

We regret to hear that the distress in Kashmir is far more severe, than was at first reported. Thousands of starving men, women, and children have flocked into our territories for food. At Sialkot, about 2,700 poor creatures are on gratuitous relief, and some 1,000 men receiving bread and small pay for working on one of those "famine relief roads" which lead nowhere, but work on which is supposed to check the demoralisation of destitution. Colonel Norgate, Cantonment Magistrate, and the civil and military authorities are working hard to combat the distress, which, however, is likely to increase if the immigration continues.

Great complaints are made of the quality of the rice now brought into Rangoon, and adulteration is encouraged by the rush for grain, that exists just now in Rangoon. So long as it can be called paddy, no attempt is made to examine its quality. Indeed a vast amount of purchases for merchants, are now made in cargo boats by men of no experience whatever. No wonder, then, that the Burman has learnt to mix chaff with his grain, in a proportion that would never have been thought of in the early days of the trade. The purchaser now only looks to the number of baskets he gets, not to the outturn it will produce, and chaff is now *bought* by traders at Rs. 10 per 100 baskets, to mix with their paddy, and to be sold in Rangoon at Rs. 120 to Rs. 130 to eager purchasers. The loss in the outturn when this mixture is milled, is something like 20 per cent.

Reports from the indigo districts are generally more favourable, rain having fallen in several districts. In Jessore and Burdwan, the rainfall averaged about 5½ inches, this being quite sufficient to enable planters to complete their spring sowings. The rainfall has also been heavy in Bhagulpore and parts of Kishnaghur, but over Midnapore the fall was partial ; whilst Maldah and Moorshedabad, so far can be ascertained, has had but little worth speaking of, and in Purneah the rain was only sufficient to freshen the growing plant. From Behar reports are somewhat conflicting, the rainfall varying from a few tenths to fully three inches, the most favored parts being Chumparun and the Northern Tirhoot factories.

In their indigo report for the past season, Messrs J. Thomas & Co. give the result of the crop of last year, as far as can be ascertained from the invoices of European indigo, and the weights after inspection and sale of native indigo, of which there was no reliable invoice. They make the total quantity 151,200 maunds, or about 14,000 maunds in excess of the figures printed at the close of the manufacturing season of the 26th October ; no less than 13,000 maunds of this excess have been in Benares and the Doab, where three-fourths of the cultivation and manufacture is entirely in the hands of the natives, from whom it is impossible to get any reliable information. The crop of 1876-77 was 103,000 maunds. It is to be remarked that while Great Britian has taken only about 1,000 chests in excess of last year, and Germany, Holland, Belgium, Italy, Switzerland, and Russia even less, the exports to France have been nearly trebled, those to America nearly doubled, and to Suez and the Gulphs about three times as those of the previous season.

The exports of indigo from 1st November 1877 to 15th March are given by Messrs. Thomas as follows :—

London	17,078	chests fy. maunds	67,048	35	6
Havre, Bordeaux, & Marseilles ...	11,490	,, ,, ,,	44,749	2	7
Foreign Europe	2,923	,, ,, ,,	11,445	1	12
America	3 616	,, ,, ,,	14,382	25	0
Gulphs, &c.	3,443	,, ,, ,,	12,863	2	0
	38,545	chests fy. maunds	150,488	26	9

The planters in British Guiana, have lately taken to the cultivation of the sunflower, and realize from eighty to a hundred bushels of seed per acre ; each bushel yielding from five to seven quarts of oil. They burn the oil in their lamps, use it for culinary purposes, and for mixing paints. Poultry fed on the seeds fatten rapidly, and owing to the oil, require no animal food. The fibre of the stalk may be used as a substitute for hemp or flax ; the leaves are relished as fodder by cattle ; the young cups of the plant, properly cooked, are an agreeable vegetable for the table, and the flowers are a favourite resort of bees. Its cultivation is gradually extending in the United States of North America, and in the Mauritius. The attempt to introduce it into India has not met with success as yet; some say because the ground is too poor to enable it to arrive at perfection.

A Bill has been introduced by the Hon'ble Mr. Huddlestone into the Madras Council, to prevent the extinction of game on the Nilgiri Hills, and the destruction of fish introduced and acclimatised in the streams of that locality. The general question of protecting game has been under discussion at intervals since 1869, and the Government of India have incidentally expressed themselves in favor of a close time, which is the main provision of the present Bill. The discussion was recently revived by a Committee of proprietors and residents on the Nilgiris, who represented to Government that legislative action was needed to prevent the wholesale destruction and prospective extinction of the game on the Hills, by indiscriminate shooting by all classes in season and out of season, and to protect the efforts made to acclimatise fish in the hill streams which were originally destitute of them. Their proposals were of a far more extended and sweeping character than the provisions of the measure now introduced, which only takes power for the Governor in Council to fix a close season by notification on the Nilgiris, to specify the game that may not during it be shot at or captured, and to make rules for the regulation and control of fishing there. It prescribes penalties for breach of the provisions, and provides for the appropriation of fines, &c., realized. The circumstances of these Hills are exceptional. The indigenous inhabitants are not a sporting or forest race, and the streams did not contain fish until Europeans placed them there. The area is limited; the working of the proposed measure can be closely supervised; and there are no vested interests involved save those of the residents and proprietors, who advocate the measure.

The experiments in sericulture in Dehra Doon, to which we alluded in a recent issue, are being carried on by Government, with a view of demonstrating practically the feasibility of raising really good cocoons in the Doon, and are under the personal supervision of the Superintendent of the Doon. Sericulture has been tried there off and on, in a desultory kind of way, for many years; the late Captain Hutton of Jerrapani, and another retired officer out in the Western Doon, having been the persons chiefly interested in the matter. The present Government experiments, we are told, have hitherto been eminently satisfactory, and the results this season are expected to demonstrate triumphantly, that silk bids fair to rival tea as the staple product of the Doon.

MISCELLANEOUS NOTES.

The Ashtagram Sugar Works Company, of Bangalore, has collapsed.

The Chinese Government has prohibited the cultivation of poppy, the reason being that large tracts of land formerly food-producing, are now lost to the population for food supplies.

The extent of land under cotton cultivation in the Madras Presidency has increased from 726,512 acres in 1876-77, to 985,920 acres in 1877-78, and the assessment from Rs. 9,22,004 to Rs. 12,09,672. The greatest increase is in the district of Bellary, which has 191,602 acres under cultivation now as compared with 45,388 last year, the assessment being Rs. 1,93,806 as against Rs. 40,725. The land under indigo has decreased from 122,123 to 119,590 acres, and the assessment, which was Rs. 2,82,421 in 1876-77, is now Rs. 2,54,090.

We understand that the results of the experimental famine census, taken in certain selected taluks, both in the famine and non-famine districts of Madras, have been received by the Government of India. The famine districts selected were Bellary, Karnal, Cuddapah, Nellore, Coimbatore, and Chingleput. The present population has been compared with that of the census of 1871, *plus* normal increase estimated at 1½ per cent. per annum. In the non-famine districts, the results fairly justify this standard of comparison, the population in some being slightly more, in others slightly less, than the normal thus arrived at. In the famine districts the population in every case was considerably less than this normal. The defect ranges from ten per cent. in Chingleput, to 25 per cent in Karnal and Cuddapah.

It is satisfactory to find that some good can be got out of locusts besides eating them. A scientific commission in the United States has lately made a chemical analysis of dead locusts, which shows that these insects furnish a new oil, which will be christened caloptine, and a very large percentage of pure formic acid. Though this acid exists in the ant and some other insects, it is with difficulty obtained in large quantities; whereas, by the action of sulphuric acid upon the locust juices, it passes off with great readiness and in remarkable quantity and gravity. The various uses of this acid, as a therapeutic, &c., are capable of great and valuable extension when it can be obtained so readily and in such quantity.

A lake of saline water, known as the lake of Lonar, has hitherto formed one of the most useful as well as picturesque features of the Hyderabad Assigned Districts. The salt, chiefly consisting of soda, collected from it has been widely used for washing and dying chintzes; and when, in the dry weather, evaporation reduces the level of the water, vast quantities of soda are gathered on the shore. From an official report, however, which has just been issued, we gather that the supply of soda now greatly exceeds the demand, which, owing to the distance of the lake from the line of railway, has always been a local one. The largest consumers have hitherto been the villagers in the territories of His Highness the Nizam, but the prohibitory duties which have lately been imposed on soda by the Durbar have, it is said, checked the trade in this direction. No fresh supplies were taken from the lake in 1876-77, as large stocks of unsold produce remained on hand from the manufacture of the preceding year.

The principal articles of Indian export to England are coffee, cotton, indigo, rice, wheat (an export of quite recent development), hides and skins, raw and dressed, jute, linseed, rapeseed, sugar, tea, and raw wool. The value of the export of these twelve articles and the proportion of the total exports of Indian merchandise to the United Kingdom of each of them are shown below:—

Coffee	... ...	Rs.	76,65,584,	or	2·8 per cent.
Cotton	... ...	„	6,58,63,482,	or	23·8 „
Indigo	... ...	„	1,76,92,242,	or	6·4 „
Rice	... ...	„	2,59,43,475,	or	9·4 „
Wheat	.. ...	„	1,47,69,749,	or	5·3 „
Hides and skins	...	„	2,35,38,140,	or	8·5 „
Jute	... ...	„	2,21,16,811,	or	8·0 „
Linseed	... ...	„	1,97,89,049,	or	7·1 „
Rapeseed	... ...	„	19,82,367,	or	2·9 „
Sugar	... ...	„	71,47,918,	or	2·6 „
Tea	... ...	„	2,60,11,708,	or	9·4 „
Wool	... ...	„	1,07,78,114,	or	8·9 „

The sum of these twelve items amounts to Rs. 24,92,92,210, being about 90 per cent. of the whole value of Indian produce exported to England.

An immense tract of land in Borneo has been acquired by an influential company, formed in London. They intend to open a rich and as yet undeveloped country, and coffee-planting will be one of the chief enterprises they have in view. A Ceylon correspondent writes regarding it:—"The scheme for opening Borneo is being ventilated in our local papers, and if the promoters are able to show anything like a fair prospect of success, there will be no want of pioneers from this to lead the way. The best accounts of the island speak of it as comparatively healthy, the soil as being very rich, the country well watered, the temperature moderate for the tropics, and the Dyaks, who might be employed as labourers, are a great race and highly spoken of by the missionaries who have been labouring among them. There are also Malays and Chinese in the island, but there is little of the "odour of sanctity" attached to them, they being somewhat turbulent, and requiring a good deal of 'licking into shape.' The proximity of Borneo to the great trade pathways of the East is altogether in its favour; Brunei, the capital of the newly-ceded territory, being not much further from Singapore than some of the principal ports of Java. The results of the exploring expedition which leaves Singapore for Borneo in May will be anxiously looked for, and it is to be hoped that the members of it will make their report as fine and complete as possible, The British Borneo Company will not need to expect all plain sailing, and it will be well if it has the courage to persevere, and not retire from such a promising field as was done by the earlier companies of English, Dutch, and Portuguese settlers. Of course the chances of success are much more favourable for Baron Overbeck's settlement, than any of the earlier ones; for in the days of his predecessors piracy was the normal occupation of the dweller. on the sea-board of the Malay Archipelago, and no trade could be carried on while such a state of things prevailed. Now, however these difficulties have disappeared."

GOOR, or date-sugar, is a commodity out of which the natives of some districts in Bengal make handsome profits in its unrefined state. In Upper India, the principal refineries are in the North-Western Provinces, and the chief supply of refined sugar is sent to Calcutta from the districts of Goruckpore and Ghazipore. Date sugar is manufactured in the Lower Provinces, chiefly in Jessore, Nuddea, Busseerhat, and Satkhira, in the 24-Pergunnahs, and to some extent in Furreedpore, where the date tree is cultivated. Ryots grow the trees in clusters about their houses, on the boundaries of their fields, and sometimes in open gardens occupying extensive areas. Juice is extracted from the trees in the cold season and sold, and otherwise utilized for manufacture. A ryot, after deducting all expenses, clears a profit of about six annas per tree, with the advantage of raising a cold weather, or rice crop, on the land occupied by the date garden. Each tree yields five seers of juice per season, and many yield for 20 years and over. One beegah of land is frequently made the area for one hundred trees. The local consumption of goor and date-sugar is very large and yet a great deal is exported. We learn that the genuine sugar plant in these localities has been fairly driven out of competition by the date, and is now languishing, but is extensively cultivated in some parts of Bengal and in Behar. Specimens from the Pacific Islands and the West Indies have been tried, and several varieties have been successfully reared, but their growth, before attaining to maturity, has been arrested by blight. Rungpore and Hooghly testify to the same causes of failure and deterioration. During 1876-77 the total quantity of sugar registered was, by country boat—refined sugar, 1,165,700; unrefined 2,278,900 maunds; by steamer, 11,100 and 400 maunds; by rail 303,600 and 562,700; by road 104,600 and 119,200 maunds; total refined 1,585,000 maunds, and unrefined 2,961,200 maunds. These quantities do not, however, represent the entire traffic, as a considerable quantity passes unregistered in insignificant lots which cannot be computed.

THE value of exports of rice and paddy, the staple grains of the Madras Presidency, for the last twenty-two years are shown below. The exports have fluctuated considerably, being independent mainly on the character of the season, and represent but a small proportion of the produce of the country:—

Years.	RICE. Quantity.	Value.	PADDY. Quantity.	Value.
	Cwts.	Rs.	Cwts.	Rs.
1855-56	2,687,380	54,94,531	228,813	2,54,412
1856-57	2,415,996	51,22,096	201,250	3,65, 66
1857-58	2,050,183	47,74,071	289,029	3,76,077
1858-59	1,859,214	43,92,164	221,938	4,20,5 6
1859-60	2,154,071	51,98,783	272,473	4,29,804
1860-61	2,752,482	61,8 ,74	21 ,8 1	3,58,459
1861-62	1,523,585	45,88,390	214,071	3,96,426
1862-63	1,280,812	44,85,488	215,988	4,17,713
1863-64	1,515,9 6	58,75,295	800,978	6,00,351
1864-65	1,445,987	6 ,61,255	297,174	8,57,109
1865-66	1,448,420	65,88,482	282,241	9,97,623
1866-67	1,509,829	88,78,954	240,900	6,48,739
1867-68	1,733,464	69,67,154	274,187	6,48, 67
1868-69	1,762,882	69,11,085	312,714	7,76,835
1869-70	1,478,051	59,19,187	247,078	6, 7,501
1870-71	2,048,674	74,18,894	576,162	5,51,706
1871-72	2,887, 97	85,46,649	318,70	6, 2,364
1872-73	2,110,384	8,59,319	291,041	5,93,638
1873-74	6,490,663	1,24,74,59	350, 27	7,17, 68
1874-75	5,042,118	1,08,71,512	269,7 8	6, 8,986
1875-76	3,618,794	89, 0,836	289,999	6,84,870
1876-77	1,535,165	61,74,339	226,073	5,38,350

The exports average 74 lakhs of rupees. In 1873-74 they reached nearly 132 lakhs owing to extensive exportations to Bengal on account of the famine. With the mitigation of famine in 1874-75 the exports fell to 115 lakhs, and in 1875-76 to about 96 lakhs. The extensive failure of crops and the consequent famine in this Presidency in 1876-77 has, as might be expected, given a still greater check to exports, which have fallen off by nearly one-third.

OPIUM REPORT.

HONG-KONG, March 27.

THE market for Bengal Opium has been somewhat excited in the latter part of the closing fortnight. The reported strictures of the native authorities as to the discontinuance of the cultivation of the poppy appears to have encouraged speculation in the northern ports, tending to a material advance in the rates for the drug. The course of the market may therefore now much depend upon what may be authentically known as regards the yield of the native drug. Though the rise in the rates has been quite unexpected, a large business has been done in both kinds, and the present quotations are $595 to $600 for Patna, and $575 to $577¼ for Benares.

The receipts for the month, so far, stand at 3,974 chests, against 2,745 chests to the corresponding date last year. During the interval that has elapsed, some 1,150 chests have been taken by the local conservers, against 600 chests at the corresponding period last year. This, with the exportations, leaves the available supply computed at 2,600 chests, against 1,800 chests same time last year. Of this last quantity, 50 chests were Benares, of which kind the present stock comprises 600 chests.

COMMUNICATED AND SELECTED.

THE BAHMIEH COTTON-PLANT.

Report on the Bahmieh Cotton-plant (Cottonier Bamieh) *to the Egyptian Minister of Agriculture by Monsieur Delchevalerie, First Inspector of the Department.*

[*Translated from the French.*]

THIS new species of cotton, which was found some time ago in the Menúfié, and which among the natives is now known as the Bamieh cotton-plant, has straight stems, the tallest of which attain a height of three *mètres*, and instead of throwing out lateral branches, produce two or three semi-verticillated pods issuing directly from the axilla of each leaf, these being alternately arranged around the stems.

The ordinary cotton plant, on the other hand, (in its varieties: *Mako-Jumel Gallini, Ashmúni, etc.*), has the form of a shrub with one or more main stems throwing out numerous lateral branches, these occasionally spreading out to a considerable breadth and bearing pods at various intervals, two, three or even four leaves often producing no pods from their axilla. The leaves of the Bamieh cotton are large, greatly undulated, and of a deeper green than those of the ordinary cotton. Its flowers are yellow, the interior spotted with purple, somewhat like those of ordinary cotton, but they are frequently larger-sized, and grow on elongated peduncles.

As to its origin, it is thought that the contact of Bamieh plants, which existed in the cotton plantation of Birket-el-sab, having produced this new type, acted upon the seed of the cotton plants at flowering time, and that the origin of this species may therefore be attributed to a process of hybridisation between the Bamieh (*Hibiscus esculentus*) and the ordinary cotton (*Gossypium barbadense*), the more so as, when seen from a distance, the plantations of this new cotton display, like those of the Bamieh, (*Hibiscus esculentus*) a multitude of high straight stems without branches, at least as regards three-fourths of their length from the tops. If it be true that the new Egyptian cotton is the result of hybridisation between the two species above named, the fact is one of great importance to science, because in the annals of horticulture the process between species differing so widely is rare enough, and because such results as have been recorded down to the present time have generally remained sterile, or at best but of little use in the sequel; whereas in this case Nature has produced a more fertile cotton than the ordinary kind.

During the past summer at Ghéziréh, we have by way of experiment artificially crossed the Bamieh and the ordinary cotton, and the seed thereby obtained will be sown in the coming spring, and its growth watched during the summer season in order to verify the theory, and to ascertain whether the seed thus artificially obtained will produce the same species as the one found to occur spontaneously in Menúfié.

On comparison with the ordinary kind this new cotton shows too great a difference, to be accepted simply as a variety. If not a hybrid, it may very likely be an exotic species introduced by chance into Lower Egypt. Its origin, however, is after all a question more nearly concerning the scientific world, than the cultivator. For the latter, the essential point is the advantage it has over the cultivated kinds and varieties, in producing pods at the axilla of every leaf, in addition to which advantage, the same area under the new species will permit of the growth of one-third more, as compared to the old kind, that is, from nine to ten thousand plants per *feddan.*[*]

When duly improved by means of a rational method of cultivation, and by a judicious selection of the seed intended for sowing, the produce in cotton will steadily increase in quantity as well as in quality, for the Bamieh cotton does not as yet fully develope its pods. We have especially observed that in plantations which, owing to close crowding of the trees, are insufficiently exposed to fresh air and light, a proportion of the pods remain abortive—notably those situated about the lower part of the stems, and that the more elevated pods too are somewhat slow in coming to full maturity. The pods produced on the centre of the stems are usually the healthiest and most perfect. Hence it is only the seed from these which should be set aside for sowing in the following year, and it must therefore be carefully collected apart from the rest. Seeds from imperfectly developed pods, or from those growing on the bases and tops of the stems, or which have yielded cotton of inferior quality, as well as those picked from weakly plants, are only adapted for the production of oil and oil-cake. By steadily adhering to this system, this valuable species will be gradually brought to perfection. The first plantations made of this new species were treated with tolerable care. The seed was collected carefully and was sown by itself. The crop of the following year yielded a large number of plants which were again planted separately, and during the past year considerable quantities of them have been cultivated in Lower Egypt.

This year all the large proprietors have cultivated the new species, for which several hundred *feddans* have been taken up, notably in Shúbrá Kubbé on the estates of His Highness, the heir-apparent, and at Heliopolis near Cairo, &c. In Lower Egypt some of these new cotton plants are said to have yielded from seven to eight *quintaux* of Bamieh cotton per *feddan*, a result which might have been considerably improved upon, if the seed had not been subjected to fraudulent admixture, and if, instead of planting *twenty thousand plants* per *feddan*, the quantity had been reduced to one-half of this number. There is no doubt that with a more careful treatment of the seed, as above indicated, the yield could be raised to ten *quintaux* per *feddan*.

During the past spring some clever speculators having bought Bamieh cotton seeds from the peasants of Menúfié, of whom they obtained them at low rates, afterwards succeeded in selling them at excessively high quotations to the large proprietors, even obtaining as much as thirty pounds sterling per *ardeb*; but, not satisfied with even this high price, they further increased their profits by mixing the seed of the new species, of which they had practically acquired the monopoly, to a considerable extent with seed of the ordinary varieties, owing to which all the planters have this year been grievously disappointed. We became aware of this practice last June, and immediately weeded the plantations under our supervision of all the *branched cotton* plants which were found to be growing intermingled with the *unbranched Bamieh* cotton plant in order to prevent any degeneration in the new type. We strongly advise landowners growing *Bamieh cotton*, to plant it separately for the future, and as far away as possible from the ordinary kinds, so as to prevent any degeneracy in the new type.

Having thus removed all the country cotton plants, which were found to be growing among the *Bamieh* species, we obtained a pure kind, of which a portion, which in consequence of the weeding had more space around them than the rest, have produced as many as three or even four horizontal stems, still retaining, however, the character of the main stem and producing pods, in lieu of lateral branches. The new species is keeping up well, and we have reason to believe that it has been so completely established after several years during which it has been already cultivated. Many planters of Bamieh cotton have, like ourselves, taken the precaution to weed out the branched plants which they found growing in their plantations of the new species. But unfortunately many of them have allowed the mixture of the two species to continue Next spring it will therefore be necessary to take special care in the purchase of the seed of the new species, and to exact valid guarantees of its purity.

In the month of June, and during the first fortnight of July, the new species was attacked by a large hairy caterpillar which caused considerable damage by eating the leaves and the tips of the young buds. Towards the end of July the caterpillar disappeared, and it was impossible afterwards to find even one of them in the plantations. Towards the end of summer, after the disappearance of these caterpillars, the small caterpillars which have now for a long time past ravaged the Egyptian cotton plantations, and for the study of which a commission under the presidency of His Excellency Sherif Pasha (of which we are a member) was appointed by the Home Office in 1871, made their appearance. This small caterpillar which attacks the American and Indian cotton plantations, as well as those of Egypt, finds its way into the pods, perforating the epidermis, and feeding on the albumen contained in the seeds, and completely soils the fibre enveloping the seed.

Several entomologists, with whom we were in correspondence at this time, ascribe this caterpillar (the Egyptian variety) to the genus *Tortrix*. Dr. Boisduval described it in 1873 under the appellation *Eriophaga gossypiana*, and this learned entomologist recommends that the infected pods should be carefully cleaned of all caterpillars, and that *these should be burnt*, so as utterly to extirpate the pest.

GOVERNMENT EXPERIMENTAL FARMS.

BANGALORE EXPERIMENTAL FARM—REPORT FOR FEBRUARY 1878.

Superintendent—Mr. F. E. Harman, M.R.A.C., F.C.S.

Rainfall.—There has been no rain throughout the month.

Dry land (high).—Castor oil seed and Togaray have been harvested. Ploughing (with English plough) has been actively prosecuted where practicable after removal of cotton and gram crops, and where sprouted weeds required checking.

Dry land (low).—Bengal gram flowering freely; crops patchy through the necessity of sowing indifferent seed. As this crop is not largely grown in the neighbourhood, only North Indian seed was procurable in the bazaar.

Land not under crop reploughed to experience the benefit of the action of the sun and air.

Land irrigated from wells—Turmeric harvested. Experiments on the value of different manures applied to this crop will shortly be available.

Guinea Grass.—Occasionally watered as labour is available.

Sugarcane No. I.—A plot has been ploughed 12 inches deep and ridged with English ploughs 18 inches apart, sets planted between ridges on freshly-watered land.

Sugarcane No II.—A second plot has been prepared in the same manner and planted in rows 18 inches apart alternately with sugarcane sets and Queensland maize.

Melons.—A plot of melons is growing well. The young plants are dug round, weeded, and manured with a top dressing of equal parts of village refuse and tan bark as they attain a sufficient size; ¼lb. of manure is applied to each pit containing three or four young plants.

Maize.—A plot of maize has been sown on the land formerly occupied with turmeric by the usual plan of throwing up ridges with an English plough two feet apart, and planting along the furrows at a foot distance from seed to seed.

Crops of maize sown in December are growing well under occasional irrigation.

Plantains.—Shoots planted in 1876 are now bearing freely. New shoots are being planted in parallel trenches dug three feet deep. As a blue clay sub-soil is found at a foot and a half below the surface, care is taken to disturb this and leave it in large clods without bringing it to the surface. The expense of digging trenches is but a little more than that of the ordinary method of making pits, as the coolies having more room can work with greater freedom and rapidity. The plantains are put in 6 feet by 6, at a cost of one anna and 3 pies per set. The advantage of this system of deep cultivation is found in the length of time which plantains so grown can exist without water. During the dry weather of 1877 a single watering during three months, which with the short supply of water in the wells was all that could be attempted, was found sufficient to keep the plants in health.

Potatoes—The crop is making satisfactory progress.

KHANDEISH EXPERIMENTAL FARM—REPORT FOR MARCH 1878.

Superintendent—Mr. A. Stormont.

SUGARCANE-CRUSHING has been in hand most of the month. The mill on trial is a small horizontal one with three-foot 1¼-diameter fluted cast-iron rollers

Turned by two pairs of bullocks, it crushes on an average 4,500 canes, or 5¼ tons weight daily, the outturn of *jagri* being 9½ cwt. This is a lower rate than resulted from similar experiments last year. The decrease is owing to the water-supply in the Jamda canal having failed six weeks before the crop came to maturity. This had the effect of lignifying the canes and fixing part of the sugar, as was proved by the *megasse*, which was submitted to the crude diffusion process of the *kumhar* (potter), and yielded an additional 15 per cent. of inferior *jagri*.

Land for the new cane crop has been broken up and manured at the rate of 30 tons of farmyard manure per acre.

The sericultural operations of the month have been mostly confined to reeling, and the farm apprentices have made considerable progress under the instructions of the Baboos A sample reeled by them independently has been described in Bengal as " silk even, and in most other respects fairly good. The only real defect is its being slightly undertwisted."

The production is also much improved, being now up to the rate of 7½ tolahs silk from one pound of cocoons. The maximum in skilled hand is eight tolahs.

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[*] The *feddan*, containing 420 square *mètres* is usually made to bear from six to seven thousand cotton plants of the ordinary kind, and any over-cropping beyond this would be incompatible with a rational method of cultivation,

Owing to the scarcity of river water, much attention is being directed to the different kinds of *deep* well-pumps and water-lifts. The following four have been worked more or less constantly during the month :—

1st Burgess and Key's No. 2 Bucket-lift, 40 feet well.
2nd ditto No. 2 ditto 20 to 30 feet.
3rd ditto No. 1A ditto 20 feet.

Statistics of the working of these machines have been regularly taken for the information of visitors. A 35-feet chain pump and bullock-power apparatus have been lent to the Patel of Chikultan for trial previous to purchasing one for himself. The senior agricultural apprentice has been detached for the purpose of instructing the Patel's people in the method of removing, erecting, and working the pump.

A pneumatic windmill pump, a new invention, has been ordered for the farm.

The linseed crop has been threshed out during the month. The implement used was Ransomes, Sims, and Head's small-sized thresher, which does the work effectually and quick. The haulm of the linseed plant—usually a waste substance—is on account of the scarcity this year being cut up in the chaff engine in certain proportions with wheat straw, &c., and thus forms a palatable fodder.

Like other dry *rabi* crops the linseed is turning out badly this year, as regards quality as well as quantity : the weight per bushel averages 2½ lbs. less than last year's crop. Of other grain-crops the results of the harvest have not yet been obtained.

The ploughing of stubble was finished about the middle of the month. On account of the dryness of the ground, European and American ploughs have been of but little use.

Nagpur Model Farm—Report for March 1878.

Officer in charge—Captain J. W. Macdougall, Deputy Commissioner.

The area of the farm is 461·72 acres, of which 60 acres are occupied by farm buildings and roads. The soil of the farm is very variable and much intermingled. Roughly speaking it may be classified as follows :—

2nd class black cotton	66	acres.
Black cotton and grit	29¾	,,
Muram unculturable	17½	,,
Unculturable in rains and too light for rabi crops ...	70	,,
Black cotton resting on muram	140¼	,,
Black cotton and muram intermingled	113	,,
Friable clay	3½	,,

The 70 acres unculturable in rains and too light for rabi crops consists of a soil which is utterly deficient in humus and is in the rains a quagmire. It is proposed to place this area under forest plantation. The 140¼ acres of black cotton resting on muram is a fair soil, sometimes very shallow, and requires to be carefully treated to prevent the sub-soil being brought to the surface. It now has a fair seed bed, and if the season is not too wet yields up to the average. The 2nd class black cotton soil when manured, limed, and irrigated, yields very large returns. These 66 acres are chiefly devoted to experiments.

The farm is irrigated by an open channel, taken from a head formed under the embankment of the Ambajhari tank, the leakage from which is the chief source of supply. The supply is not sufficient for the wants of the farm, and measures are under consideration to increase the flow of water.

The fields are manured with stable dung from the farm sheds and with latrine and village sweepings. The latter are pitted together and left for one year undisturbed, after which it forms a very stimulating manure. The supply is however not sufficient, 20 acres being the most that can be yearly manured.

The present condition of the fields is in tilth and in bearing capabilities above the average of the best lands in the vicinity ; but owing to the careless husbandry practised all around there is great difficulty experienced in keeping them clear of weeds during the monsoon. The high cost of cultivation per acre, *viz.*, 3-12 to 4-4, arises chiefly from weeding by hand being constantly requisite if a crop is to be kept in good order.

There are 19 pairs of cattle on the farm, and the English machinery in use consists of two threshers, two chaff-cutters, a cotton gin, a pea-crusher, four winnowers, two sugarcane-pressers, a corn-dresser, the whole being driven by cattle power. The whole of the crops except *túr* and *til* pass through the threshers and winnowers. There are six English ploughs and six horse hoes, the tines of the latter having been lengthened to permit of their use as cultivators during the breaks in the rains. Of native implements the following are used :—Four improved native ploughs with mould boards, the native *bakars* or scarifiers, the *tiffan* or seed-drilling machine, and the *dowras* or weeding hoes.

The average outturn per acre of each crop has not as yet been worked out, but it may be said generally that the outturn of all crops will be very poor this season. Cotton has been up to the average ; jowar suffered when in cob from the rains of October and November. Linseed and gram were damaged by the untimely fall of rain when in blossom ; wheat has been ruined by rust. Thur has been a fair crop Sugarcane has been above the average of the neighbourhood, and the *gur* now being made is pronounced as worth Rs. 5 to Rs. 6 per kandi above the value of the stuff ordinarily offered in the market.

Experiments were tried during the past year with lucerne, which yields well, guinea grass which is at present cultivated for propagation, English wheat which failed to germinate, ground nut, carob, and mesquit beans which are at present in the nursery. Both these latter promise to succeed under garden culture, but it is doubtful whether treated as an ordinary farm crop they will prove of much value.

THE GARDEN.

VEGETABLE GARDENING IN INDIA.

MUCH attention has lately been attracted to vegetable gardening in India, and the following notes have been collated and condensed from well-known publications, to afford information to the amateur gardener in this country.

In the first place, the gardener must know how to prepare the soil to suit the seeds, and to plant them in such a manner, and at such a time, as to ensure their growing. The best garden soil is composed of equal portions of chalk, clay, sand, and vegetable mould. In many stations, as one or other of the earths are not procurable, the nearest approach to them may be substituted, as slaked lime for chalk, &c. As vegetable mould forms the flesh of the plant, it is better to give an excess of this than too little. All large-headed vegetables as the cabbage, cauliflower, broccoli, consume very largely the nutriment contained in this mould, and it is scarcely possible to give them too liberal a supply of this manure. As to the depth of soil, it is hard to lay down any definite rule for guidance. Most gardeners are content with three feet, which appear to be ample. Drainage is of vital importance ; the more room there is for the admission of oxygen, the healthier will be the plants. As regards situation, the site should not be enclosed with high trees, or dense shrubs. Nothing is more injurious to vegetables than the dropping from trees : it is ablutionary water of an objectionable character.

For tap-rooted and bulbous vegetables, a northern site should be chosen ; while a south-west aspect should be selected for edible-leaved plants Light and air should be given as much as possible, and shade should be avoided altogether. Watering must depend upon the nature of the soil. A retentive soil, like clay, requires less water than a friable soil. Much injury is often done by excessive watering. When the water percolates at once through the soil, and is not allowed to stagnate, little or no injury is done. An evening watering is equal to two in the morning. Manures are invaluable to a garden, but they should be judiciously given. Peas are ruined with manure, while the cabbage tribe are starved without it. All stable litter should be allowed to heat and thoroughly rot, so that it will almost crumble in the handling before it is disposed of in the garden. The manure from goats and sheep is much too strong, and requires to be given with caution ; that from cows is better, mixed with stable litter and allowed to decompose with it. Liquid manures are made by adding three pots of water to one part of solid manure, allowing the same to ferment and subside. This should be used in a diluted state, by adding one-third part of water.

Artichoke.

Cynara scolymus.

There are two kinds of this esculent, the conical and globe. They may be propagated by seed, or suckers. If the former, they must be planted in drills twelve inches apart, and the distance between the drills should be nineteen inches. They should not be disturbed until they are at least a foot high, when they may be planted out at a distance of three feet from each other. Suckers may be treated in the same way as young seedlings. A rich soil produces an abundance of heads. If watered freely, little care is necessary, as the plants die down and come up again. The time for planting is July to September. A new bed should be made every fifth year.

The tubers of the Jerusalem artichoke (*Helianthus tuberosus*) attain a considerable size. Small tubers are usually reserved for crops and planted whole. The plant grows to a height of six or seven feet and blooms freely. White-ants commit great havoc if the tubers are left too long in the ground after they have matured. The soil need not be very rich. The tubers should be planted fifteen inches apart, in rows two feet wide, and treated much in the same manner as potatoes by earthing up. When the stems die down, the tubers should be taken up, and stored between layers of sand, free from the ravages of mice. The time for planting is May.

Asparagus.

Asparagus officinalis.

This hardy esculent does not reach perfection before the sixth year of its existence, and its cultivation is best understood in France. The seed should be taken fresh from the berry, in a dry and matured condition, and sown in a bed previouly prepared by mixing a layer, six inches deep, of good manure with sand. The seed should be plantad in drills, ten inches apart, and flooded occasionally. When the plants are nearly a year old, it will be necessary to select sites for trenches : these should run north and south. Trenches should be formed in the shape of the letter V, the width at the top being two feet, with a gradual gradient towards the apex of the letter, leaving a width of eight inches for the bedding of the plant. The depth of the trench should be twenty-two inches; four inches of good rich soil is to be added every year, and the exhausted soil removed.

The plant is in its prime in its sixth year, and may be cut for a period of two months. When the plants are ready for transplanting, each plant should be taken and placed in eight inches of black soil, composed of old manure, the roots extended, and planted carefully in the centre of the trench. When the plants are three years old, they may be cut sparingly. In using the knife it will be well to guard against cutting unseen shoots. Large growers of asparagus never cut the same trench two consecutive years. When the shoot is six inches above the surface, it may be cut two inches below the earth. Young stems should be tied to a stake to prevent their being broken. Old stems should be allowed to wither and die off the plant. The season for planting is August. The kinds mostly grown are the Giant, Connover's colossal, La Hative d'Argenteuil, l'Ordinaire.

THE RUNNER BEAN.

Phaseolus multiflorus.

This bean seldom succeeds below Lahore, but grows to perfection in the Himalayas, where it puts forth an abundance of flowers, and crops heavily. The runner is best grown in the plains by stopping its climbing and making it grow in the form of a bush; this is done by nipping off all running shoots as they appear. It must be then planted in rows, thirty inches apart, and a single bean must be placed every twelve inches, under two inches of earth. If grown as a runner, it must be supported on rods or poles, or may be grown over a lattice. Three inches must separate each seed in this plan of growing. The plant must be watered moderately. In Lower Bengal it must be planted in September, in the North-West in October, and the Hills in April.

COMMON BEAN.

Faba vulgaris.

This bean may be planted in October, two inches deep, in rows, with a space of two and-a half feet between them each seed must have a space of six inches. If the beans have not been soaked previously to sowing, the earth must be very moist at the time of planting them out A north aspect is the best. This pulse too frequently disappoints the grower. It comes up strong, puts up several shoots, and throws out a head full of buds and bloom, but these fall and die, leaving a bare and almost withered stalk.

BEET.

Beta vulgaris.

Beet for table use is either red or white, called silver-leaved the former is used for salads, and the latter is used as a spinach, or a substitute for asparagus. The soil should be well prepared and dug to the depth of three feet, all clods being finely broken, and stones, if any, removed, and manure of a previous year mixed with salt and sand well dug in. When the earth is prepared, make ridges four inches high, with a distance between them of fourteen inches. They should be made to run north and south, free from top shade or shelter of any kind.

For an early crop, seed should be planted in boxes or earthen pots in August; these will be fit to plant out in September; consecutive crops can be obtained by sowing up to January. Plants are easily transplanted, care being taken not to injure the root. The second crop should be planted on ridges, two or three seeds being placed in one hole. The distance between each plant should be twelve inches. When four leaves appear, the weak plants should be rooted up and thrown away. When the plants have been in the ridges a month, they should be cleared of weeds and any broken leaves. Great care is required in this operation on account of the bitterness of the leaves; they should at this time be earthed up to the crown. The plant must be watered freely.

CABBAGE.

Brassica oleracea.

Seed for early cabbages may be sown in a box or pan in the middle of August. The soil should be light and well drained with charcoal foundation. A later crop may be planted out in October from September plants. Planting out may take place when six leaves have appeared, always selecting the evening for the work. Water freely when all have been planted. Each plant of the smaller kind must have a square of 15 inches. A hole should be dug in the centre, two feet deep, by eight in diameter; this should be filled up to two inches of the surface with rich old manure. Mixed with a little earth, the young plant is then inserted and firmly pressed down. The larger cabbages require a square of three feet as a bed. Water and light are life to a cabbage as much as manure proves to be its food. An occasional dressing with liquid manure is very beneficial.

CAPSICUM AND CHILLI.

Capsicum.

The plants are very extensively cultivated. The seed may be sown any time in the cold weather, and the plant will continue bearing well until the rains. Sow in pots, well drained, lightly covering the seeds. When four inches high, plant out into beds made of ordinary garden soil. Water moderately. Cut the fruit stalk, as the stems are apt to be injured by taking the fruit any other way.

(*To be continued.*)

FORESTRY.

A PAPER was read at a late meeting of the Linnean Society, entitled 'Notes on Mahwa Tree (*Bassia latifolia*),' by Mr. E. Lockwood. This tree grows in abundance in India; a hundred thousand may be seen on the plains around Monghyr. Wild animals of all kinds greedily devour the flower, of which one tree will yield several hundredweights. Besides being nutritious to man, it is an excellent fattening agent for cattle. A strong-smelling spirit is obtained by distillation of the corolla, an essential oil from the fruit, and as an agent in soap-making the tree is invaluable. Thus certain yield, unlimited supply, nourishing and chemical qualities, easy preservation, and its cheapness, all combine to render it a commercial product of no mean importance to our Indian Empire.

Raising of Eucalyptus seedlings.—We commend the following plan, recommended in the *Indian Forester*, to the attention of those about to raise a supply of *Eucalyptus* seedlings for planting out:—

"Ordinary hollow bamboos are taken of about 1 inch to 1½ inch in diameter, and cut up into pieces four or five inches long each, of course open at both ends. Square beds are then prepared, just four or five inches deep; in fact so as to form a sort of trays in the ground; the bottom of the bed may be trampled down; and if there is gravel and stone, so much the better, as the roots will not be tempted to penetrate it.

"The little tubes are then set up side by side till the square is full and looks like the top section of a honeycomb. A quantity of good earth is taken and sifted, or made into powder free from stones and sticks. This is sifted or shaken over the bed till all the little tubes are full to the top, and the interstices between them; 3 or 4 seeds (not more) are now by hand planted into each tube. A little practice enables this to be done very quickly. The seed has only to be lightly covered by an additional sprinkling of earth.

"When the plant is grown to a few inches the superfluous plants or weak ones may be weeded out of the tubes, and the tubes are now ready to be put out in their *final* position in the forest. No risk is felt to the roots. The bamboo gradually decays and the plant is established."

FOREST REPORTS.

MYSORE.

THE only forest successfully protected from fire has been the Shankargudda, in the Nagar Forest Division. The *Carob* and *Mahogany* trees are in a flourishing condition, while a large number of *Sal* seedlings were destroyed by a grub, stated to be of a species of cockchafer. The sales of timber and bamboos amounted to Rs. 69,501. The quantity of sandalwood sold was 922¼ tons. The receipts from the district forest depôts amounted to Rs. 34,073 against an expenditure of Rs. 19,000. The value of the free grants of wood and bamboos made to the ryots for the reconstruction of their houses destroyed by fire amounted to Rs. 756. The number of licenses issued for felling wood in the "exempted" taluks of the Nagar Division was 213, which realized Rs. 2,448. Number of trees in groves was 825,963. Out of 3,818 miles of road in the province, 3,627 miles are stated to have been planted up with trees on both sides. Total revenue, Rs. 4,66,956 7-2½; expenditure, Rs. 2,26,861-13-8.

CENTRAL PROVINCES.

The area of the reserves was 2,391 square miles and 60,669 acres In Hulhko the cutting over of badly-grown teak was carried out over an area of 500 acres, comprising one compartment, and gave an outturn of 20,600 marketable pieces. The experiments in lac propagation are far from satisfactory. When the Inspector-General of Forests visited the Korai plantation in January 1876, he predicted that the insects would soon kill the trees on which they were. The trees on which the lac then was are, however, in perfect health, but no lac has been yielded by them, and there is no sign of living insects on the trees, all having died off in the hot season of 1876. In the Southern Division the failures have been complete, and in the Western attempts at propagation have not been successful. In the Central Division the only timber operations were the cutting and transport to Nagpur and Kamptee of 30,000 bamboos. The total area of unreserved forests amounts to 16,444 square miles, and 331 acres. One remarkable feature in the Saugor District forests is a small plot of about 100 acres, in which sandalwood is now naturalized; the best portion is, however, not the property of Government. The continuance of the licence system in the

Oogly forests has proved satisfactory, the receipts having risen to Rs. 3,185, against Rs. 2,566 in the previous year and Rs. 1,885 in 1874-75. In the Malui Ilaka, lac cultivation on a small scale appears to have been very successful. One hundred kusum trees were stocked, on 90 of which propagation was reported as successful. Fifty-two maunds were also gathered from a previous stocking, in which 4 maunds of seed lac were used, and which cost in all Rs. 248. A few blocks of forest were leased out for lac production for a term of five years, but the income derived was only Rs. 287-1-0. Grand total of receipts for the year is Rs. 6,61,326-1-6. Expenditure, Rs. 2,88,640 6-10. Amount realised on account of timber, &c., sold, Rs. 1,22,241-2-0.

BENGAL.

The total area of reserved forest is 3,390 square miles. In the Darjeeling Division an experimental *India-rubber* plantation, covering an acre, had been made in August 1876. The seedlings were 12 months old when planted out, and are now growing well. By the orders of Government an experimental *bamboo* plantation, extending over an area of one acre, had been established. The object was to ascertain how many tons of young shoots, fit for paper manufacture, could be produced per acre. In the Julpigoree Division the areas occupied by each class of forest are approximately these : sal savannah and mixed forest=270 square miles ; lower hill forest with sal=20 square miles ; khair and sissu forest=100 square miles. Some of these forests contain mature timber, as for instance the Buxa reserve, which is capable of yielding at once about 80,000 cubic feet of timber per annum. The greater part of the forests is, however, in a reduced condition, and it will take years of conservancy to stock the areas completely. The Dooars are now being opened out for tea cultivation. The Rhotas slopes contain about twice as many trees per acre as the plateau, and there is a good proportion of khair and ebony. Of sal there is very little. In order to ascertain whether bamboos could be grown to advantage in the Sunderbuns for the manufacture of paper stock, 1,190 root off-sets, partly of *Bambusa tulda* and partly of *Bambusa balcooa*, were planted on a piece of ground adjoining the baobab plantation during April, May, and June 1876. Out of this number only 92 were alive on the 1st July, namely, 78 *Bambusa tulda* and 14 *Bambusa balcooa*, and these were looking so sickly that they were not expected to live. One of the roots was pulled up and examined, when it was found to be quite black and rotten, although it had been planted only a short time. There can be no doubt that bamboos will not grow on land which is flooded by high tides. The area of unreserved forests was 5,120 square miles ; area of plantations 524 square miles ; area of forest tracts actually protected from fire during the dry season of 1876 77, 66,127 acres ; revenue, Rs. 2,2?,401-7-5 ; expenditure Rs. 2,11,688-14-3 ; number of trees felled during the year, 74,720.

AJMERE.

The total area of reserved forests in Ajmere and Mhairwarra was 64,360 acres, or nearly 100·5 square miles ; the area of plantations 311 acres. The proposed forest expenditure for the five years, ending 1879 80 is—conservancy and working, Rs. 43,422; establishment salaries, Rs 53,779; total, Rs. 97 201. During the last six months of the year about 610 maunds of charcoal were manufactured at the Todgarh tract. The cost of manufacturing was Rs. 85 ; and 118-5-40 maunds were sold for Rs. 135. The villagers of Hathikhera and Kotra, and "Telis" of Ajmere, were allowed to exercise the privilege of cutting grass during the season. In accordance with the arrangements made by the settlement officer in 1,682 bighas taken up in Hathikhera and Kotra, the inhabitants of these villages have the right to cut the grass during the first two days after *Dasera*, and afterwards in common with the Telis of Ajmere, always provided the forest officer has not closed any portion for reproduction under section 5 of the Forest Regulations. Out of the trees planted during last rains, about half of the jamun trees are dead. About 70 Bombay mango grafts were planted in the Tarragarh valleys during the rains of 1874, but now only 27 trees remain, 21 of which are in a flourishing state. Gorumji, one of the peaks in the Todgarh tract, is supposed to be of a volcanic nature, and is occasionally shaken by slight shocks of earthquake. The outlay on account of forest administration was Rs. 22,458.

COORG.

The two blocks of reserved forests proposed to be set apart for coffee cultivation were surveyed and found to measure 5,853 acres. The total area of reserved forests at the close of the year was 381¼ square miles. The sales of timber realized Rs. 15,513, as against Rs. 24,217 in the preceding year. The quantity of sandalwood collected was 52 tons. The quantity of sandalwood sold was 39½ tons, which realized Rs. 21,319, or an average of Rs. 540 per ton. Of the charges for conservancy and works, Rs. 14,699 were expended on the production of revenue, and Rs. 3,794 on the maintenance and improvement of the forests. The receipts from "firewood and charcoal" were only Rs 1,996 against an outlay of Rs. 1,767. In accordance with general orders 6,500 bamboos were supplied free of seigniorage to the 28th Regiment Native Infantry for their huts. A free grant of 697 poles and 6,000 bamboos was made to the ryots of a village in North Coorg, their houses having all been destroyed by fire. They were allowed to fell the wood themselves in unreserved forests. Having felled trees instead of poles they were stopped, the trees seized, and the case reported. Total receipts were Rs. 75,928-11 ; total expenditure, Rs. 33,328-11-3 ; net realizations, Rs. 50,191-11-8 ; number of timber and bamboos felled, 76,992 ; amount realized on account of the different classes of timber sold, Rs. 15,512-9-1.

HYDERABAD ASSIGNED DISTRICTS.

The total area of the Northern and Southern Divisions is 1,400 square miles, 339 acres. The principal trees grown in the Northern Division are, teak, tewus, mowah, moka, danun, salti, &c. Salai (*Boswellia Thurifera*), which is the most plentiful tree on the western sides, almost entirely disappears towards the east. On an average the tree growth may be said to be about 30 feet high. The only bamboo in the forest is the *dendrocalamus strict s*, which is about equally distributed over the entire area. The total cost of demarcating the Kinwat reserve forest was Rs. 463 0-9. The number of inhabited villages in the Bairagarh reserve was shown to be 68, with a population of 5,105 souls, and a cultivated area of 7,275 acres. The number of villages has since been reduced to 56 by the desertion of 12 villages. Of those left, 16 may be considered black soil villages, or villages under permanent cultivation, and 40 red soil villages, or villages within which the shifting of cultivation common to the Melghat, and which is so injurious to the forests, is practised. The area under cultivation in the Gujamel reserve is estimated to be 1,960 acres ; and the number of cattle in reserve 744. Only two fires broke out in the Bairagarh reserve during the year, but they were extinguished before any harm was done. Both fires were accidental, and the area burnt on these occasions was less than 12 acres. In the Garu-Matergaon reserve (Southern Division) 2,499 acres were burnt out of a total area of 46,420 acres. A large fire broke out in the Kinwat reserve, which burned over 12,000 acres, or about one-fourth of the forest. Total area under plantations was 1,441 acres; the expenditure, Rs. 32,347 9-3 ; the nursery of teak and anjan at Boarkaira proved a failure. The financial results of the year were, Rs. 2,53,135-11-8 ; expenditure, Rs. 94,373 7-9 : surplus, Rs. 1,58,562-3-11.

ASSAM.

The area of the Government reserves or State forests in the district of Cachar was 236 square miles, and in the Inner Line reserve 509 square miles. The Deputy Commissioners were directed to impress, during their cold weather tour, upon the mouzahdars, the headmen, or the zemindars, and even upon the ryot himself, the very serious consequence that might ensue from an act of often mere carelessness ; and they were to cause it to be clearly understood throughout their districts that in future ignorance of the consequences of rashly setting fire to jungle or grass would not be accepted as a plea in bar of the punishment to which any person thus rashly originating one of these destructive fires might lay himself open, and a vernacular proclamation for publication throughout the districts was issued. Plantation work at the Kulsi, in the Gauhati Division, was restricted to the filling up of vacancies in the teak plantations with Nahor, Tun, and Sisu, to get the areas already started completely stocked. The preparing of the area set aside at the Kulsi for the experimental rubber plantation was completed, and 400 cuttings are already to be planted out in the new lines as soon as the weather permits and for the filling up of vacancies. The Charduar rubber plantation has been extended by 110 acres, and was surveyed, mapped, and divided into blocks. The growth on the whole has been very satisfactory. An extensive sowing of indigenous oak was contemplated in the Shillong plantation, but the year proved one in which hardly any of the oaks bore seed ; it is hoped to carry out the measure in the current year. The young oak seedlings of 1875-76 were after transplanting regularly searched after by the rats, which bit off the plants, ate the acorns, and thus destroyed nearly the whole plantation. These pests are exceptionally destructive in these hills, and they are so numerous in some years that there is no remedy for them. Inquiry was made by Government during the year regarding box-wood fit for engraving blocks, and the Inspector-General of Forests drew attention in circular to the same, and the possibility of woods for furniture even being exported at a profit from this country to Europe. Accordingly, the three following kinds have been cut and seasoned, with the view of sending specimens home to obtain a report on them :—Ahoy (*Vitex peduncularis*), which might possibly answer for engraving blocks ; Bola (*Morus leavigata*), and Amari (*Amoora espectabilish*), which might be acceptable for furniture, and are said to take a good polish. The Bola is of a bright yellow colour, somewhat resembling Satin-wood, whilst that of the Amari is of a dark red, not unlike Mahogany. The Engineer-in-Chief of the Northern Bengal State Railway has taken five sample sleepers of each of the following kinds on trial:—Ajhar or Jarool (*Lagerstrœmia reginæ*); Gunserai (*Cinnamonum glanduliferum*) ; Sidah (*Lagerstrœmia parviflora*) ; Sam (*Artocarpus chaplasha*) ; Nahor or Wagessur (*Mesua ferrea*). In the reserved forests the duffadars or wood-cutters worked out 21,813 pieces of dead sal-wood, 17,513 of which were sold. On application being made to the Divisional Forest Officer, licenses are granted to cut timber for six months on the payment of one rupee for each person ; similar licences are granted for elephants for twelve months on the payment of one rupee for each elephant. The number of licences granted for cutting timber, bamboos, &c.,

was 1,511, and elephant licences 77. The only raw material for dyeing purposes exported from Assam to Calcutta, to the extent of about 1,000 maunds annually, is the Indian Madder or "Manjit," which includes both *Rubia Maunjista* and *Rubia Cordifolia.* The total area of reserved forests was 1910·45 square miles; of unreserved forests, 6157·95 square miles; of plantations 619 1-6 acres; and forest tracts protected from fire during the dry season of 1876, 35,274¼ acres. The grand total of expenditure of the different divisions was Rs. 89, 919 11-9; number of trees felled, 1,412, of which 797 were disposed of; amount realized and due on account of sales, Rs. 3,283-1-1.

INDORE.

The working of the forests to the north of the Nurbudda, under Mr. Carey, was very satisfactory. These forests yielded a net revenue of Rs. 17,000, against Rs. 1,802, the revenue of the previous year. This amount, that is nearly 10 times that of the last year, does not include the large quantity of wood ordered to be issued to the Military and other Departments as seignoiage.

The centrifugal pumps sent for from England were found to be of no use unless worked by steam. I am not yet able to report whether these pumps worked with steam would prove cheaper than raising water by buckets worked with bullocks.

Mr. Carey, the Chief Engineer of the State, reports:—

"*Forests.*—Since last year the jungles of the Bai districts have been added to my care; much fuel, teak bullies and logs for shoring up foundations of bridges have been supplied to the railways.

"Large quantities of bullies are being supplied to the Military Department, Indore, and to numerous village people for building their houses and for farming purposes.

"*Sleepers.*—Experiments have been and are being tried on railway sleepers; in February last year, 6 Sali sleepers were cut green and immersed in a tank (made expressly for the purpose) filled with Behera leaves and water; in June following these sleepers were put down on the Neemuch State Railway, and are to this day as sound as the day they were put down. This wood was always considered next to useless, as being so readily attacked by insects, but five months' soaking in solution of Behera leaves, whose tanning properties are well-known, has proved that sleepers can be obtained from this tree. We have vast quantities of Sali in our jungles, well grown, capable of making on an average quite 8 half-round sleepers from each tree; of course, time will test the life of these 5 sleepers; at present they look most healthy and promising, and if they turn out long-lived, we are safe to find a market on the two lines of Holkar and Neemuch State Railways, and thereby make a good revenue.

"One hundred Sali sleepers were cut in June 1876, and laid in the Kanar river and left during this monsoon with the intention that all impurities should be soaked out in the running water; after the rains only 49 sleepers were found; the rest had been washed away; these have been laid down on the Holkar State Railway by the kind permission of the Engineers; on trial they appear sound, but the action of weather and being constantly run over by trains will soon test their worth. We could supply Unjen sleepers, but they are worth more to us at the Indore market as logs than being cut up into sleepers; the rate for sleepers being rather at a low price.

One thousand nine hundred and four Unjen and 130 Teak trees have been trimmed, lower branches cut away, &c., to try and produce a larger growth of tree. Several of the Teak trees, which have been cut down, have been chopped in such a way that a better growth of shoots may spring up, and only one and two allowed to grow up, so that with care we may expect good straight bullies."

MADRAS.

The area of the forests of the Madras Presidency is not accurately known, but is officially set down at 5,220 square miles, of which 3,150 are situated in the Cuddapah and Salem districts. It would appear, however, from the Administration Report of the Forest Department for last year that except certain fuel reserves in districts through which the railways pass, and a few trifling tracts elsewhere, no strictly reserved forests exist from which cattle and fire can be rigidly excluded. Alienation of tracts, which it is highly desirable to reserve for timber, fuel, or climatic considerations, go on without check every year in the absence of legal power to enclose the wastes. The forest officials are unfortunately placed, for they are unable to prevent the encroachment of an impoverishing cultivation over the very forest which, in the interest of sound agriculture and sanitary well-being, should remain intact. There is also the havoc of the temporary hill cultivation of the natives known as "Kummari," which burns up the growth of years, in order both to dispense with the trouble of regular tillage, and to obtain ashes for the manure of a single crop. The revenue derived from this source must be small, but the Government which have to increase the salt duty cannot seemingly afford to lose it, as the Conservator makes up his mind for the continuance of a system which causes a great amount of injury.

For all this, however, the Administration Report shows good work done. The heads of the Department have travelled till their health suffered, and there has been a steady advance in demarcation, survey, felling, and road-making. An outlay of Rs. 4,13,970 was cautiously and somewhat peculiarly balanced by a flourishing income of Rs. 4,15,312 with teak, rosewood, and other stock in hand, to the value of Rs. 3,49,694.

DEVASTATION OF FORESTS.

AT the request of the Commissioner of the Jullundur division, the Conservator of Forests, Punjab has lately examined the curious low range of soft sand-stone hills running across the Hoshiarpore district from the Sutlej to the Beas. Composed of soft, friable strata, partly sand and partly pebble conglomerates, these hills have been denuded of their vegetation and now present bare surfaces to the furious action of the tropical rainfall,—in this district about 30 inches in the year. The consequence is, that torrents (locally called *chos*) descend during the rainy season with great violence, carrying down vast quantities of sand and depositing it in broad belts over the most fertile parts of the district lands that would otherwise yield crops of sugarcane and other valuable produce. With each succeeding rainy season there is more erosion, and the sand belt increases both in length as a heavier flood than usual, carries its burden of sand further down, and in breadth. Directly the waterflow is over, the sand dries up; and, baked and sterilized by the action of the sun, is carried away by the hot winds of summer, and spread out over the fields. So great is the mischief, that even the lands of the Jullundur district are afflicted and a serious diminution in the value of land is imminent. Already, the people have been driven to try some remedies, the chief being to arrest the lateral spread of the sand by planting tufts or masses of *munj* grass. But these efforts want direction and combined action, besides which the root of the evil remains untouched; the sources of these torrents are left alone, and as long as that is so, more and more sand is being washed down continually. Denudation of brushwood and trees is the cause and the history of the hills is only that of many others not only in India but in Europe. In the fertile plains of Hoshiarpore, settled government and the development of trade produced their natural effects,—an increase of wealth and of population. Villages rose apace and then the villages swelled into town; the demand for fuel increased, and these hills had to supply it; reckless cutting followed and then the evil began. Cattle also multiplied and what with the devastation of the bill-hook, the browsing of goats and camels and the trampling of buffaloes, the hills were denuded. One may march for miles passing torrent-bed after torrent-bed, and with nothing before the eye but a dull sandy-brown chaos of irregular hills and fantastic cliffs, half broken down and falling away. To the Deputy Commissioner, Mr. W. Coldstream, may be given the credit of first bringing the matter to notice, and of making systematic inquiries into the cause. His action is by no means premature, for the evil is clearly spreading. Villages that were noted in the old settlement as unaffected by the *chos* have now lost a large portion of their arable land, or have had it damaged seriously. Remissions of land revenue become a necessity. Moreover the supply of firewood becoming exhausted, the village groves in the plains are disappearing. Large banyan and peepul trees, the growth of a hundred years, are sold for two or three rupees to charcoal burners. Yet there are people still living who recollect thick jungle on these "outer Siwliks," and wild elephants and tigers were found on the north side scarcely ninety years ago.—*Pioneer.*

LAC IN INDORE.

MR CAREY reports:—

"We started the production of Lac after the first fall of rain in 1876, and sent to the Central Provinces for 20 maunds of Lac, collected from the Kusumb trees; this was tied at once on to 1,043 trees in our Burvaee and Rallamundal jungles; but I am sorry to say the result was not satisfactory; portion of our seed may have been destroyed in transpotation which may account for so many trees not taking; besides monkeys and ants aided in destrucition, came and ate up a very great deal of our stock; from what remained and from what we found on other trees in the district and seed sent from Indore, we made another trial and tied on to 159 trees in other districts and put on Shikarries to drive off the monkeys. After the first fall of rain in 1877, I shall increase our area of Lac-producing district and spread the seed all over the district. We may always count on our Lac being propagated by birds taking Lac from one tree to another, and proximity to old trees. I shall not attempt to collect Lac for the market, but tie on all I can. I hope this time next year to commence collecting Lac for sale.

"In the city of Indore and its neighbourhood I found 842 trees covered with Lac. I have in May and June collected a large supply of stock, which I shall distribute all over the district. At the village of Sauver and its neighbourhood 40 trees were found with Lac on; 25 maunds of Lac was collected from this stock, and I am still collecting from Indore stock. I hope when the season for tying on comes round to distribute our Indore stock to a considerable area, and I have no doubt when our Lac-bearing trees are carefully guarded, the produce will be very great. We have no enemies above the Ghats like what we have below, except indeed the grass-cutters belonging to the Elephant Department, who wander about with their animals, cutting down our Burr and Peepul trees, which forms the greatest number of our Lac-bearing trees. The Plum or Berr tree produce large quantity of Lac. This tree is also cut for making fences round fields.

"Too much must not be expected of us at first; we are young at this work; it is only by experience and careful studies we can hope for success."

Forests and their climatic influences are beginning to attract attention in Australia, and Baron F. O. Mueller, an authority on the subject, writes as follows:—"How forests beneficially affect a clime, how they supply equable humidity, how they afford extensive shelter, create springs, and control the flow of rivers,—all this the teachings of science, the records of history, and, more forcibly still, the sufferings or even ruin of numerous and vast communities, have demonstrated in sad experiences, not only in times long past, but even in very recent periods. In what manner the forests arrest passing miasmata, or set a limit to the spreading of rust spores from ruined cornfields; in what manner their humid atmosphere and their feathered singers effectually obstruct the march of armies of locusts in the Orient, or hinder the progress of vast masses of acrydia in North America, or oppose the wanderings of other insects elsewhere, all this has been clearly witnessed in our own age. How the forests, as slow conductors of heat, lessen the temperature of warm climes, or banish siroccos; how forests, as ready conductors of electricity, much influence and attract the current of the vapours, or impede the elastic flow of the air with its storms and its humidity far above the actual height of the trees, and how they condense the moisture of the clouds by lowering the temperature of the atmosphere, has over and over again been ascertained by many a thoughtful observer. In what mode forests shelter the soil from solar heat, and produce coolness through radiation from the endlessly multiplied surfaces of their leaves, and through the process of exhalation; how, in the spongy stratum of decaying vegetable remnants, they retain far more humidity than even cultivated soil; how they with avidity re-absorb the surplus of moisture from the air, and refresh by a never-wanting dew all vegetation with them and in their vicinity, has been explained, not only by natural philosophy, but also often by observations of the plainest kind. How forest trees, by the powerful penetration of their roots, decompose the rocks, and force unceasingly from deep strata the mineral elements of vegetable nutrition to the surface, how they create and maintain the sources for the gentle flow of watercourses for motive power, aqueducts, irrigation, water traffic and navigation; how they mitigate or prevent malarious influences, of all this we become cognizant by daily experiences almost everywhere around us.

"Let us then take timely warning; let us remember that denuded earth parts with its warmth by radiation, and is intensely heated by isolation; that thus in woodless countries the extremes of climate are brought about in rendering the winter cold far more intense and boisterous, and the summer heat far more burning and oppressive. Let us remember why the absence or destruction of forests involves periodic floods and droughts, with all the great disasters inseparable therefrom. Let us bear in mind that even in our praised Australia many a pastoral tenant saw his herds and flocks perish, and even the very kangaroos off his run, how he looked hopefully for months and months at every promising cloud which drew up on the horizons only to dissolve rainless in the dry desert air; while when the squatter's ruin was completed, the last pasture parched, and the last waterpool dried up, great atmospheric changes would send the rain clouds over the thirsty land with all the vehemence of precipitation, and would convert dry creeks into foaming torrents, or inundate with furious floods the very pastures over which the carcases of the famished cattle and sheep were strewn about! Picture to yourselves the ruined occupant of the soil, hardly able to escape with his bare life from the sudden scenes of these tragic disasters! Fortunately, as yet such extreme events may not have happened commonly; yet they did occur, and pronounced their lessons impressively. Let it be well considered, that it is not alone the injudicious overstocking of many a pasture or the want of water storage, but frequently the very want of rain itself for years in extensive woodless districts which renders occupation of many of our inland tracts so precarious. Let it also not be forgotten how, without a due proportion of woodland, no country can be great and prosperous! Remember how whole mountainous districts of Southern Europe became, with the fall of the forests, utterly depopulated, how the gushes of wide currents washed away all arable soil, while the bordering flat land became buried in *debris*; how its rivers became filled with sediment, while the population of lowlands were at the same time involved in poverty and ruin! Let us recollect that in many places the remaining Alpine inhabitant had to toil with his very fuel for many miles up to the once wooded hills, where barrenness and bleakness would perhaps no longer allow a tree to vegetate! It should be borne in mind that the productiveness of cereal fields is often increased at the rate of fully 50 per cent. merely by establishing plantations of shelter trees; that the progress of driftsand is checked by tree plantations; and that a belt of timber not only affords protection against storms, but also converts sandy wastes finally into arable meadows, thus adding almost unobserved, yet unceasingly, so far to the resources of a country."

A great deal of what is said above, will apply to India as well as to Australia; we believe that the subject of replanting our forests has the most anxious consideration of Government.

MINERALOGY.

Mining operations at the Warora Colliery, Central Provinces are being vigorously pushed forward, and are now of a most promising kind.

Captain Donnan has been engaged for some time past in making his annual inspection of the Ceylon pearl fisheries, and the results of his examination show that one of the finest fisheries known for many years, may be anticipated in 1880. A fishery is also expected next year, and another in 1882.

The Rao of Kutch, we hear, has engaged a geologist and mineralogist to report upon the commercial value and mineral resources of the country. We trust the results will be encouraging to the enterprising Rao; there are some copper mines in Kutch, which only require capital and energy for their development.

Messrs. Nicol & Co., of Bombay, have offered to take over all existing mining companies in Wynaad, and after thoroughly testing the reefs through their claims, to start them on a proper basis. Some of the Companies have accepted the offer made to them by Messrs. Nicol & Co, while with others, negotiations are still pending.

Coal in Java.—Coals have been found along the track of the railroad through the Preanger Regencies (Java). Geologists affirm that the whole archipelago is full of coals, but the misfortune is that most of the places where the coals lie are inaccessible to means of transport. Such is the case with the Lebak coals, and with the immense deposits on the inhospitable south coast of Bantam—not to mention the Ombilien coal-fields which cannot be termed inaccessible. Therefore it is of importance that now coals in payable quantities have been found along the track of the railway through the Preanger above Sukabumie. Where they crop out the seams are not thick, but in extent are very considerable, and it would indeed be a wonder if large quantities be not present. The Government has taken the matter in hand seriously, and a mining engineer has been despatched to the spot, who, for his investigations, will make use of the *personnel* of the railway survey, and will also search for the most promising place where there is to be made a tunnel, 400 metres long, required for the railway in that quarter. There also appears to be further an intention to ascertain on both sides of the proposed railway line the mineral contents of the soil. The coals found are of excellent quality.

THE BENGAL IRON WORKS.

From the report of the Bengal Iron Works Company, Limited, for the half-year ended the 31st of December last, it appears that owing chiefly to the depressed state of the iron trade the progress of the Company has been slow, but nevertheless satisfactory. Operations can only be said to have begun in August last, when the No. 1 furnace was lighted, since which it has worked steadily, the average run of metal daily having been twenty tons, and the quality of the iron excellent. No. 2 furnace could also be got ready to run off a similar quantity of metal if required in less than three weeks; but at present there is not sufficient work for two furnaces. What will be of most interest to shareholders and the public is the fact, that "any doubts as to the demand for the produce of the foundry may be considered solved. The Company has entered into a contract with Government for 5,000 tons cast-iron sleepers to be delivered by 31st October on favorable terms. Pipes, gutterings, &c., are being made for other customers, and the foundry has full work before it." And with regard to the supplies for the furnace, we are told that contracts have been entered into with the leading Coal Companies for the supply of coke. No other fuel than coke has been used in the furnaces. Limestone is now laid down at the works at Rs 4 per ton, and it is hoped that further reductions in the cost of this article will shortly be effected. The supply is unlimited, but the quality being inferior to English limestone, a much larger quantity has to be used than in England. Ironstone abounds all over the Company's property; naturally it is being lifted nearest the works, so that the cost is merely nominal. In quality it bears favourable comparison with any worked at home.

The Planters' Gazette.

TEA.

THE hail storms which have passed over a great part of Northern and Eastern India, have done considerable damage to tea estates in Darjeeling and the Kangra Valley. In the latter place all hopes of plucking in April have been destroyed.

A MEETING was lately held at Shanghai, to consider the advisability of adopting a system of weighing tea there, to correspond with that at the port of London; that is to say, that upon every package of tea, grossing 25lbs. and upwards, an allowance of 1lb. be made by the seller to the buyer. The feeling was unanimous in favour of such a rule, and it was resolved to press the matter upon the attention of the Chamber of Commerce.

WE learn from Messrs. Thos. Watson and Co.'s Tea Report, that the exports from Calcutta to Great Britain last month were 1,139,378lbs, as against 681,338lbs. exported in March 1877. We notice that the exports for the first three months of 1877 were in excess of the deliveries, whilst this year the deliveries for the first three months are three millions in excess of the exports, and yet prices for teas under 2s. are about 6d. per pound lower than then. The exports from China to Great Britain and the Continent during 1877-78 were twelve millions less than in 1876-77.

IN March 1877 the deliveries of Indian tea in London amounted to 2,200,000lbs. In March of the current year they amounted to 3,400,000lbs. From the 1st January to the 31st March the deliveries in London for 1875-76, 1877-78 were—5,172,000lbs, 7,100,000lbs., 6 600,000lbs., and 9 700,000lbs. The stocks in London on the 31st March 1877 were 12,100,000lbs This year on the same date they amounted to 17,300,000lbs. In 1875 and 1876, respectively, they were 8,777,000lbs. and 10,153,000lbs.

IMPORTS of tea into Ceylon are strangely fluctuating, as the following figures show:—

Imports of Tea at Ceylon Ports:—

YEAR.	Entered for Home consumption.	Customs value.	Duty paid.
	lb.	Rs	Rs.
1873 ...	69,494	1,92,862	17,374
1874 ...	59,469	1,37,027	14,867
1875 ...	85,025	2,01,678	21,216
1876 ...	58,497	1,51,178	11,617

For 1877 the full particulars have not been published, but the total imports will not be short of 84,208lbs. (51,776lbs. at Colombo, and 34,432lbs. at Galle), or more than the average of the last five years, notwithstanding the increasing local production. It is evident, therefore, that in many quarters, locally, Ceylon tea is not appreciated (perhaps owing to the higher cost), and it is sent away in increasing quantities, as follows:

Exports of Ceylon-grown Tea:—

YEAR.	Ceylon produce.	Customs value.
	lb	Rs.
1873 ...	23	58
1874 ...	492	1,900
1875 ...	1,158	2,302·50
1876 ...	757	1,907
1877 ...	2,105	......

There are over 2,000 acres now planted in Ceylon, half of it two years old and upwards, and this year will probably see either a largely increased export, or a stoppage of imports.

WILLIAM MORAN & CO.'S RESUME OF LAST SEASON'S OUTTURN.

Calcutta, April 5.

IN accordance with our annual custom, we now submit particulars of the actual as compared with the estimated outturn of the past season, together with estimates for the coming season. In future we will endeavour to publish this information about the 1st April as at present, instead of as formerly, about the 1st May.

	Estimated Crop, 1877-78.	Actual Outturn, 1877-78.	Estimated Crop, 1878-79.
Assam	18,987,780 lbs.	18,726,858 lbs.	21,593,060 lbs.
Cachar and Sylhet ...	9,989,520 ,,	9,589,300 ,,	11,862,880 ,,
Kurseong, Darjeeling, Terai, and Dooars ..	5,097,400 ,,	5,254,445 ,,	5,910,170 ,,
Kumaon, Kangra Valley, and Dehra Doon	1,535,300 ,,	1,398,785 ,,	1,638,050 ,,
Chittagong ...	678,900 ,,	530,995 ,,	717,000 ,,
Chota Nagpore ...	177,000 ,,	209,500 ,,	247,400 ,,
TOTAL ...	36,465,900 lbs.	35,709,883 lbs.	41,463,060 lbs.

After deducting the quantity taken for country consumption, which we estimate at about two million pounds, there will be, when the exports for the year are made up, a slight discrepancy between the actual outturn as above given and the quantity shown as exported by the returns furnished by the Customs, which we account for by the fact that many shippers in making out their passes calculate the weight of each chest at 80 lbs., and of each half chest at 40 lbs., whereas 90 lbs., and 45 lbs., are, in our opinion, much nearer the true weights. The actual outturn, it will be seen, has fallen short of expectations by about three-quarter million pounds; but planters are to be congratulated that the result has been no worse. The weather on the whole was somewhat unfavourable and during the earlier part of of the season it was feared the crop would turn out considerably short.

As regards the estimates, a much larger yield was to be looked for during the ensuing season, inasmuch as the extended area which has been brought under cultivation of late years is now giving greatly increased returns. At the same time in submitting these figures, one very uncertain element must always be considered, viz., the weather; and looking at the results of past seasons, we are disposed to reduce the estimate of the probable total outturn to forty to forty-and-a-half million lbs., which quantity from thirty-eight-and-a-half to thirty-nine millions will probably be exported.

It appears from Messrs. Moran & Co.'s last tea report that deliveries of Indian teas from the London warehouses for the six months October 1877 to March 1878 compared with the corresponding six months of previous season, have been steadily increasing; and as exports during March were not large, and will be on the usual small scale during the months of April and May, we may, if the present rate of deliveries be maintained, expect to see the stock in London considerably reduced by the end of June next.

If therefore the quality prove satisfactory, Messrs. Moran anticipate a good demand for the new teas; but in face of a largely increased supply, and assuming that exports from other countries will be on the same scale as formerly, it would be idle to expect anything like a return to the old range of prices, especially for those kinds which come more directly into competition with China tea.

THE RED SPIDER.

THE *Darjeeling News* has distinguished itself by writing a note on the red spider, which has elicited the following letter from TUPAC YUPANGUI, addressed to a contemporary:—

So much has been said and written about the red spider already, that it seems almost boldness to recur to the subject. What has decided me to do so, however, even at the risk of being considered pertinacious, is an extract from a mofussil paper, reproduced in your issue of the 11th instant, which would seem to hold forth the general ignorance on the subject as greater than it seems to me it really is.

Our knowledge is very scant and by the tea planting community, as a rule, considered as nothing or to no avail, because it does not extend to the discovery of efficient means to stamp out the pest which has so seriously affected their interests. But when it is thrown in our faces that we know nothing about the spider's natural history, propagation, and habits, and it is merely acknowledged that the so called red spiders are "acari of some sort," we must endeavour to point out what we do know, and thus in part define to a certain extent what remains to be known and calls most urgently for further investigation. Regarding the origin of the red spider, we are not more ignorant than we are regarding the origin of any other living thing; but whether it can be traced back through other specific forms to a distinct and simpler one, or has always existed in its present shade and how its primary form, whatever this may have been, was generated, is as much hidden to us as is the origin of life in our own highly organised frames, or in the lowest cryptogamic growth.

Of its natural history, habits, and propagation, we cannot plead such ignorance. Indeed, the red spider has amongst the mites been for a long time one of the best known and the most particularly observed. Its anatomy, growth from the egg to the imago (and even some of the apparent changes in the ovum), and its general habits, have all been observed and treated of in print by naturalists of high standing. The Indian red spider is for all practical purposes the same as the common European hothouse red spider, and even in zoological classification it is very doubtful if its slight differences of structure can authorize its being set down as more than a mere variation of *Tetranychus telarius*.

As to the practical part of the question as affecting the interests of tea planters we must plead incapacity, but I cannot help feeling from the accounts we hear of the ravages of the little animal, its sudden appearances and disappearances, that opinions are not based on sufficiently careful observation, and that very frequently cause is mistaken for effect. Now I have examined tea plants at all seasons, and even in the coldest part of the year have never failed to find the red spider, and healthy, fertile-looking eggs on some bushes. In the cold weather there are certainly very few, and these are comparatively sluggish and inactive; but as soon as the warm weather sets in they awaken to renewed activity and vigor in the propagation of their species.

Good and thorough cultivation, we are told, has frequently given good results in lessening the spider, and it no doubt has lessened its evil effects; but I cannot imagine that cultivation in itself actually diminishes the numbers of the arachnoid. It simply gives vigor to the bush, and thus enables it to withstand the weakening effects of the blight with less apparent detriment, just as a strong, healthy man might support drains upon his strength without shewing fatigue, where a weak, cachectic man would fail and give way.

As to the rain putting an end to the spider's ravages, it undoubtedly does so for a time, probably by the simple mechanical process of either washing the spiders off the leaf, or destroying them in situ; but the eggs remain firmly adhering to the leaf, and are neither washed off nor destroyed; consequently, as soon as the rain has stopped, all these ova begin to furnish a new generation. The action of the rain has, besides this, the same favourable influence as cultivation, and in giving strength and growth to the bush, it assists in obliterating the injurious effects of the blight as well as attacking its source.

I fear to intrude too much on your valuable space, but as I think it may be of interest to many of your readers, I will give an extract of a letter I received from Mr. Andrew Murray on the subject shortly before his lamented decease. It runs as follows.—

"I have just been consulted as to what I would recommend to be done to save the tea plantation from insect pests that are doing a deal of mischief in Assam and elsewhere. To answer such enquiries, I would require to have a great deal more local knowledge than I possess. One of the first enquiries naturally is, where the supply of insects come from? Of course if it is a common inhabitant of the surrounding jungles or forests, it will be of little use to try to clear it out of the plantations so long as these jungles remain as a focus from which the supply is to be constantly renewed. This is the direction in which information is most wanted. As soon as we get a destructive insect now-a-days we scarcely need information as to its habits, except in relation to the supply of food and the focus from which it proceeds. We know the general character of the mischief it does, as Cuvier could tell from the tooth or bone of an extinct animal; but we cannot tell what means or appliances there are for starving it out, which is the only effectual way of exterminating an invasion of insects. Here the first thing is to find what other plants the tea mite feeds upon. Very possibly it will be the same mite as the one that attacks the camellia, at any rate nearly allied to it. I should like very much to hear from you what are the facts in this respect, and whether you see any means by which it could be starved out. Here, where we have annual crops changed every year, the means of starving out a pest that is special to one kind of crop are easy and patent if only people would combine to use them simultaneously. If a whole district were to drop the growth of wheat for one year, we should get rid of all the annual insects that feed on wheat in the district, and there are few that are not annual, but you cannot do that with perennial shrubs like the tea plant."

It is very difficult to do anything with insects by local application. We can indeed catch a flea, but *uno avulso non deficit alter*, still in some cases local applications do answer.

TUPAC YUPANGUI.

Calcutta, April 15, 1878.

USEFUL HINTS ON TEA-MANUFACTURE.

THE Market for the sale of Indian teas during the past season, up to the present date, has been exceptionally unfavourable, owing to a combination of causes—partly to the prevalence of general commercial depression; partly, it may be, from increasing importation of Indian teas; and partly, no doubt, from these having consisted of an unusually large proportion of low class teas of weak liquor, which, possessing no marked superiority in strength and character over ordinary China growths, naturally sink to the same level of relative value. The first of these causes may be assumed to be temporary; the influence of the second is more likely to increase than to diminish, and can only be met by increasing efforts to attain to a more perfect system of economical working, the last is more immediately within our control, and the best means of combating it merit the most careful attention and vigilance on the part of managers and assistants in charge of estates.

Some of the more important points to be kept steadily in view are:—

1*st.*—Gathering the green leaves at an earlier stage of development—allowing at the commencement of the season a free growth of shoots for the formation of young wood. It does not necessarily follow that this would entail any material reduction in the amount of the crop, and any partial loss in quantity would be more than compensated for by the higher standard of quality and value attained, and by the healthier tone that would be imparted to the London market by the general adoption of this principle. In like manner any partial or occasional reduction in the daily task for leaf-gathering, rendered necessary by this system, would be fully covered by the greater money value of the day's work, whilst there would be a substantial relative economy in all the subsequent operations, inasmuch as a maund of green leaf giving tea worth an average of *1s. 6d.* per lb. costs quite as much in charcoal, manipulation, lead, boxes, and freight, as one giving tea worth 2s. per lb. Taking even the extreme case, then, of a reduction of one-fourth in the bulk of the crop, if accompanied by a corresponding improvement in the quality, there would be a positive saving of 25 per cent. in the items indicated, whilst the market would be less glutted, and the absorption of the inevitable increase of importations incident to extension of cultivation would take place under more regular and natural conditions.

There are no doubt times—such as when a sudden flush of leaf comes out simultaneously all over the gardens—when it would be difficult to carry out this system and at the same time gather all the leaves. If such cases cannot be adequately met by a partial gathering of the suitable leaves over the whole area, then there can be little doubt that, rather than go on gathering coarse large leaf to produce comparatively worthless and unsaleable teas, it would answer better to suffer a portion of the garden to run completely *banjie* for a time, and to turn back and gather the leaf, while in a suitable condition, on the earlier plucked portions. The ease with which a basket may be filled with overgrown leaf no doubt affords a strong inducement to the coolies to persevere in that direction, but this is a minor difficulty which no competent manager would admit himself unable to control. The manager has also to guard against a tendency on his own part to strive after *bulk* in his crop as being the most important consideration, and the test by which he is likely to be judged. The sooner this illusory principle is discarded, and *quantity*, without being lost sight of, made strictly subservient to *quality* and *profit*, the better it will be for all concerned.

2nd.—The subsequent treatment of the leaf in the tea house—the withering, rolling, fermentation, firing, sorting, and packing—all demand careful attention and supervision, if the fruits of all the preceding labour and expenditure—just within our grasp so to speak—are not to be more or less sacrificed and lost. In "withering" it is necessary that there should be ample space, and in "rolling" that care should be taken to avoid putting too much leaf into the machine at one time, and not to carry the process to excess, thus injuriously affecting the strength of the liquor to obtain, what is of infinitely less value, a well twisted and good looking leaf.

Important, however, as these operations are, there is less room for serious error in them than in the following one of "fermentation," to hit the right degree of which requires more study and discrimination than are generally given to it; and failure at this point is, beyond doubt, one of the most prolific causes of "poor teas of weak liquor." It is no unusual thing to meet with two samples which, having as nearly as possible the same appearance in the dry state, show such a marked difference in the infusion as to make one worth from *3d.* to *6d.* per lb. more than the other, a difference generally traceable to an error in fermentation though it may also occur in the firing—more frequently from insufficient than from over firing—or from the tea being allowed to lie about and become more or less musty before packing.

While the two extremes, of *over* and *under* fermentation have to be avoided, the general tendency is to err on the side of excess. This sometimes occurs from inability to recognise the true indications of sufficient fermentation; sometimes from a want of appreciation of the importance of the point, allowing it to be treated in a haphazard routine fashion by the tea makers. One cause of over-fermentation may be found in the habit, prevailing in many tea houses of allowing the leaf to lie about in heaps too long before firing, waiting for space to be available on the dhooles or trays, there being a tendency, more especially in factories where steam is employed for the purpose, to push on the rolling of the leaf without giving any consideration to the adequacy of the accommodation to firing it off while at the right stage of fermentation. Another fertile cause of over-fermentation, producing dull, weak, and sour teas is want of care in seeing that the fires are kept brisk and bright, and that no more leaf is put on each dhoolie or tray than can be quickly fired off. When a thick mass of leaf is put over a slow fire, the fermentation of course goes on even more rapidly than before, being stimulated by the gentle heat, and a dull sourish tea is the certain result. Rolled leaf is in a fit state for firing off just as the original green colour is turning to pink. The outturn of the infused leaf should be a bright salmon-brown.

The first firing has thus been incidentally dealt with; the sorting, being a mechanical process which may be modified from time to time to meet the requirements of the market, does not call for special remark in this paper, beyond pointing out the great importance of its being done as promptly as possible, to be followed by an equally prompt final firing, carried to the point when the tea gives off the well-known malty aroma, and packing in a warm state—a most essential condition—so as to preserve the full freshness and aroma of the teas. Delay in this, and allowing the teas to lie about exposed to the atmosphere, is next, if next, to error in fermentation, a most common and potential cause of deterioration, and one which cannot be too watchfully guarded against. Whilst, then, the most strenuous efforts should be made to have all the operations (from the time the leaf is gathered till it is packed as tea) following each other in their due order without needless delay, it may sometimes happen from pressure of work and an inadequate labour force that this cannot be accomplished unless at a greater sacrifice than would result from a temporary delay in sorting and packing. To meet such cases, each factory should be provided with a few zinc-lined bins for storing the made teas, or, where these do not exist, bins may be easily and cheaply made of ikra and naga mats or machangs raised from the floor a sufficient distance to allow of charcoal fires being kept constantly burning below them.

On the subject of *Breaks*, it may be remarked that while it is desirable to have these of a good size, the system of rebulking in London renders it unnecessary that the tea in each break should be of uniform character and quality, so long as it is of the *same class*, and so long as *unsound* or very inferior teas, are not mixed, or breaked, with *sound* and *decidedly* superior sorts. This admits of packing being carried on uninterruptedly with each day's teas, simply putting the chests containing each class by themselves till they are numerous enough to form a break, which should not, if possible consist of fewer than fifteen chests.

As a final, and very important suggestion, it should be a rule with every manager or assistant in charge of a tea house, to practise frequent, if not daily, tasting in the cup, carefully comparing the liquor and infused leaves with those of samples known to be good.

This being the test by which brokers and buyers in England are guided in the sale and purchase of teas, it is certainly no less essential that it should be systematically and carefully applied by the producers in India in order to obtain an approach to certainty, or anything beyond empirical, haphazard results, in the standard of quality.

To many experienced careful managers these suggestions may read as so many truisms, with which they are already thoroughly familiar; and we are happy to be able to point to several by whom they are duly appreciated and acted on. On the other hand, there are numerous instances where there has been such manifest failure in one or more of the above primary conditions of the success, with corresponding loss to the owners of tea property, that we deem it our duty, in the present rather critical position of the Indian tea interest, to draw attention to them in as prominent a manner as possible.

GEO. WILLIAMSON & CO.

7, East India Avenue,
London, March 8th, 1878.

TEA PRUNING.

[By Childe Harold]

(Concluded from page 138.)

THE evaporation which takes place in the leaves, consequent on the exposure to the air of the crude sap in them, is a potent cause* of the ascent of that sap in the stem, and of its collection by the roots. As long as the leaves remain green and healthy, and continue exposed to air and light, so long will the roots go on collecting from the soil fluid which the young wood of the stem will transmit upwards in a steady stream.

The vigour of the one process is accurately proportioned to that of the other. The roots will not long collect, neither will the young wood of the stem transmit fluid, for which there is no demand for in the leaves above. If from any cause the demand made by the leaves should be suddenly reduced (as it would be by the removal of branches in pruning), the supply of sap, which had been collected to meet the previous demand, would thus become excessive, and excess would be got rid of either by the discharge known to gardeners as "bleeding," or by the plant making an effort to utilize it by rapidly putting forth new shoots and branches. Suppose, for instance, that a tree in full health and vigour be cut down close to the ground, either of two things may happen - the sap in course of collection by the roots will either simply run to waste on the surface of the cut stem, or a growth of young shoots will spring up round the margin of the stump, or from the under-ground stem. Shoots originating in this way are known in gardening as suckers; and the vigour and rapidity of growth shown by many of them, though often surprising, is easily explained when we consider that they are nourished by a root system calculated for the leaf system of a tree.

If shoots arising in this way be persistently cut down as fast as they appear, and the root system be thus deprived of all demand for its collections, and as it were of all object in life, it will soon decay and die. It is needless to say that, on the other hand, the growth and vigour of the leaves are modified by circumstances affecting the roots; and that any injury to the latter soon tells upon the former Let us now consider for a little what systematic pruning and plucking of the tea plant really amounts to; and what it is that the planter demands of the bushes in his garden. In the operation of the above, the plant is regularly deprived, during the season of active vegetative activity each year, of its young expanding leaves, and of the growing extremities of its branches In other words, it is systematically deprived of the parts that are at once the organs of its digestion and the instruments of its growth, as fast as it provides itself with them.

Were the deprivation complete, the plant would simply die. But even in the most over-plucked gardens, it is only partial.

Not only, however, does the planter thus continuously deprive the plant to a serious extent of the very organs of its life and growth, but he demands that it shall continue for a series of years to be submitted to this process (plucking), and still continue healthy and vigorous; or, as he phrases it to give good flushes. Observe, too, the kind of leaves which have to be used for the manufacture of good tea. Are they old mature leaves, whose vital functions are sluggishly performed, and whose best days have past? The tea-plant being an ever-green, a large proportion of such might be removed without injury. It is not these, however, that are taken, but the young and growing, in which sap circulation is rapid and free, in which the vital processes are carried on with vigour, and to which the young branches bearing them, and, indeed, the whole plant, look chiefly for the materials of life.

Where the planter has asked the plant to yield up these for a succession of years, while he on his part, you may say, has rendered but small help in the way of manure and tillage, and improper pruning, it is not to be wondered at that tea-planting has in many cases proved but partially successful.

Now, if we think of the matter for a little, the process of "plucking" will be seen to be really of the nature of pruning; and to recommend pruning as a cure for the evils of "plucking," let us consider briefly the appearance presented by a young shoot of tea before the tip has been taken off by the plucker. Such shoot bears on its entire length, let us say, ten leaves, and at the point where each leaf springs from the stem, *i.e.*, at the axil, there lies a small bud. Each of these buds is capable of development into a lateral branchlet. In a branch bearing, as we have supposed, ten leaves, it is not probable that, were things left to their natural course, each of the ten axillary buds would become developed into lateral branchlets.

When, however, the growing point of the shoot is removed, these axillary buds are stimulated by the ascending sap, and most of them expand into lateral branchlets, and these being in turn topped by the plucker, their axillary buds are stimulated, though in a less degree, into expansion, and so on. The vigour with which lateral branchlets follow on "plucking," or topping the leaders, diminishes regularly with each repetition of the process, until after a year of season of this treatment a period of nearly complete stagnation is reached, and the original ten-leafed shoot with which we started presents the appearance of a tough, greyish barked stem, bearing at its top a dense collection of small wiry twigs, which carry a quantity of small thin tough leaves totally unfitted for manufacture into tea. These twigs are of such low vitality that, when topped, they hardly throw out fresh lateral shoots or "flushes." The reason of this is simply that the small brush-like mass of shoots have increased in number out of proportion to their means of nourishment. The stem, through the sap-wood layer of which their nourishment is transmitted, has not increased proportionally with the number of the leaves which has been forced into existence by the operation of plucking; and it is a physical impossibility that, through the layer of sap-wood in the stem, there can be transmitted enough sap to support many young leaves in addition to the old ones with which its top is crowded. Were such a stem left to itself, and all plucking suspended for a time, it is probable that in some cases an equilibrium would be established between the leaves and the sap-wood, and that the latter would again become extensive enough for the transmission of sap sufficient to support a natural succession of young leaves, or in other words "yield flushes;" but the process of recovery would involve time which to the tea-planter means money. A quicker way, therefore, of obtaining leaf must be tried, and this is found in pruning off the wiry spray and useless wood with which the bushes are more or less crowded, and cutting back to a proper height all strong growing shoots, so that the sap transmitted upwards may cease to be wasted in the support of leaves which can never be made into tea. These, as long as they remain on the plant, must have their needful supply of sap, and, further, that the sap may be directed into the new shoots which the plant may be expected to throw out after the pruning It is thus that pruning becomes the necessary sequence of plucking, if healthy young leaves fit for tea-making are sought to be continuosly produced The end in view should never be lost sight of when using the knife, for the mere meaningless mutilation of a plant by its application is quite as likely to be hurtful as not. It is very difficult to get native workmen to understand the kind of stems and branches they are to remove; and it will require much ingenuity and care and incessant watchfulness on the part of a manager to keep them from doing harm. As is the case with many other matters, it is easier to prune badly than to prune well: but there are few operations where the difference in results between bad and good work is more striking. In order to prune well, each bush ought (as has already been said) to be treated on its own merits; but as it is pretty nearly hopeless to think of getting native workmen who are capable of doing this, it would be necessary for the manager (after having clearly defined to himself what it is that he wants to effect, and the best way of doing it) to give his pruners a general idea of the kind of measures suitable for each portion of the garden, as they come to go over it, illustrating to them practically what kind of stems, shoots, and branches should be cut quite away, what kind should be merely trimmed, &c. It might be safely impressed on the pruners as a fundamental maxim *that old wood is to be cut away within a few inches from the root*, for it will generally be found that such wood bears no leaves of which good tea can be made, but merely the small thin sluggish sort that are carried by the broom like masses of spray already described, as a rule; then the best thing that can be done with hard old stems is to cut them off low down, in the hope that fresh new shoots may spring from the root and take its place, or from the "collar," as gardeners phrase it.

By the removal of these, not only are a quantity of useless leaves prevented from preying on the sap, but light and air are secured for the young shoots that will spring up. If a bush be entirely composed of small twigs and spray, it is a question whether a certain number of them should not be spared until a succeeding year to carry on, as it were, the life work of the plants, and not to trust entirely to the new start in life which a clean sweep of all would necessarily involve.

When we consider the influence that leaves have in promoting the collection and transmission upwards of the crude sap, it does appear more rational to leave a certain number of these old stems for one season, so that by their means sap may be attracted and elaborated for the benefit of the young root shoots which may be expected to appear as the successors of the stem that may be removed. Stems thus spared ought, however, to be cut away in the next year, by which time the young shoots will have acquired some size and will carry a number of leaves. If the mode be adopted of at once cutting down to the root the entire bush, the pruner, of course, accepts the chance of the roots sending up no young shoots at all, and, therefore, dying—a result which, for reasons above explained, is quite possible, and the possibility of which should always be borne in mind. Tea growing in unsuitable localities or in poor soil, and in tea which has been prematurely plucked, it is often the case that each stem is a plant, or a plant consisting of one stem; and to prune entirely away such a stem would, therefore, be to cut down the entire plant, which, as we have just seen, is to run the risk of killing it. A wise precaution in dealing with such weakly bushes would be, first, to hoe deep and manure the soil round them, so as to get them into a little better heart than to prune gently, and finally to cut down by the root during the succeeding cold weather.

It is, of course, a question whether it would not be cheaper in dealing with such unhealthy teas to run all risks, and to cut it down to the ground at once.

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* Dr. Hale's experiments on the ascent of sap.

The old hard stems of which we have been treating may easily be recognized by the appearance of their bark, which, often lichen-grown and warty, is always grey in colour. Young stems, on the other hand, are of a brownish colour, and often marked with dark lines. If a bush is very thick and close, and the young stems are twiggy above, and yield small leaves, they should be cut down, say six inches, from the ground; but the majority of young stems should, as a rule, be only trimmed or cut down to the height required.

In many bushes there will be found springing straight from the root a few long lanky shoots, which bear their leaves far apart and do not branch. These have probably been naturally "drawn up" owing to want of air and light; they are never likely to be of much use, and, if in the way, should be removed.

Young and vigorous trees should be cut down, as has already been said, to a proper height; small wiry twigs cut away, and all good ripe wood kept for the building up of the bush; and it should be borne in mind that the object, as much as any other, is to regulate the vegetation of the bush, and to admit light and air—most essential things for the well-being of tea bushes.

The general principles already touched upon should be carried out, and after the pruner has finished with it, each bush ought to consist of young healthy stems, with fresh-looking bark, which do not branch too much. Each bush, as I have said, should be open enough to admit air and light to its centre, and cut to flat table-like form: experience alone will teach the comparative severity or lightness of pruning which will be most advantageous to the different varieties of tea-plants and in different soils and situations.

It has not been the object of this paper to treat of other matters connected with tea cultivation.

I would merely say in conclusion that, to ensure success, pruning must go hand-in-hand with deep hoeing, careful weeding, and manuring. If these, the essential parts of all gardening and farming, be attended to, the results will be happy in spite of the low rates at which tea is now selling.

TEA IN DEHRA DUN.

Sketch of its Origin and Progress.

THE origin of the tea industry in the Dun dates back some forty years ago. Dr. Royle, then Superintendent of the Botanical Gardens at Saharunpore, recommeded the cultivation of tea in the Himalayas to the Indian Government in the year 1827, and again pressed the matter on the attention of Lord Bentinck during his visit to Saharunpore in 1831. In his opinion, Jerrapani, situated about half-way between Rajpore and Mussoorie, at an elevation of about 5,000 feet, was the best site for the experiment. About 1834 Lord Bentinck, with the sanction of the Court of Directors, determined to give tea cultivation a fair trial, and the inevitable committee was appointed to draw up a plan for carrying out this design. Guided by the fact that, "in the mountainous tracts of our northern and eastern frontier, several species of plants are found indigenous, which are also natives of China, and are not met with in other parts of the world," plants raised form imported China seed were distributed to several of the sub-Himalayan districts, and Dr. Falconer, Dr. Royle's successor, in May 1838, succeeded in growing tea plants in Saharunpore itself, from seed procured from the nurseries at Koth, in Gurhwal In 1844 a Government tea plantation was commenced at Kaulaghur in the Dun, a couple of miles west of the city of Dehra, under the management of Dr. Jameson; some 400 acres of land having been taken up for the purpose. The soil is described, in Williams's *Memoir of the Dun*, as "composed of clay and vegetable matter, with a slight mixture of sand, resting on the usual shingly subsoil, of limestone, sandstone, clay, slate, quartz, &c., found in the surrounding mountains." In 1850 Mr. Fortune, a gentleman familiar with tea cultivation in China, was deputed by Government to visit the various plantations, and reported rather unfavourably on the condition of the plants at Kaulaghur, making various suggestions for the improvement of the cultivation. Again in 1856 the same gentleman reported much more favourably on the garden, attributing the improvement to his own suggestions. This elicited a reply from Dr. Jameson, pointing out that Mr. Fortune had previously condemned the Dun *in toto* as unfit for tea cultivation; and that any suggestions he had made had been anticipated by some notes on tea planting compiled by Dr. Jameson himself. The controversy attracted some attention at the time; but it is sufficient now to note that Mr. Fortune's condemnation of the Dun as unsuited to tea, was evidently a mistake, as is evinced by the yearly increasing outturn.

In 1857 Dr. Jameson estimated the tea-bearing capabilities of the Dun as follows :—

Number of acres capable of producing tea	...	100,000
Yield per acre	...	100lbs.
Total outturn	...	10,000,000lbs.

This appears to be a greatly exaggerated estimate as regards the area available for tea, while the estimated outturn per acre is far too small, assuming anything like good management and cultivation. It will be seen from the tabular statments which will follow, that tea in the Dun, though unable, perhaps, to rival the large outturns in Assam and Cachar, which are known in some cases to be as much as 700 to 800 lbs. per acre, is not capable of producing at least four times as much as Dr. Jameson allowed; one garden of the Dehra Dun Tea Company showing an average for 1877 of more than 400lbs. per acre. On the other hand the area likely to be available for tea cultivation is considerably over-estimated. Including the southern face of the Mussoorie hills, from the water-shed down, and the northern face of the Sewaliks, the total area of the district is about 450,000 acres. Of this, fully 250,000 acres must be deducted for forest reserves, the area of the stations of Mussoorie, Rajpore, and Dehra, and for the numerous village sites Of the remaining 200,000 acres, it is improbable than any of the area at present devoted to the cultivation of cereals and other food crops will be given up; nor would such soil be profitable for tea cultivation. Deducting this area, and allowing for the considerable amount of unprofitable land, such as the banks and beds of the broad stony "*sots*," or streams in which water flows only in the rains, it is improbable that more than 50,000 acres of land are practically available for the cultivation of tea. Taking into consideration the facts that tea gardens require a considerable amount of capital to start, and entail waiting several years for any profitable return, it would appear that 15,000 or 20,000 acres is about the largest admissible estimate of the area of land in the Dun likely to be brought under tea, at least for a generation or so. Assuming that 20,000 acres may possibly be bearing tea in the course of time, and taking the outturn at 200lbs. per acre—a fair average of the present production in the Dun on the working gardens—a total yield of some four millions of pounds, or less than half of Dr. Jameson's estimate, may be looked for in the dim and distant future; but such a prospect is too remote to be of any practical value. The present outturn, although it has more than doubled in the last five or six years, is only a little over six lakhs of pounds, or about one-seventh of the possible production estimated above.

Several other tea gardens were opened out in the Dun within the decade succeeding the commencement of the Government plantation at Kaulaghur; and by the year 1862, about the same time as the elder Williamson was planting out garden after garden in Assam, and several tea companies had been formed there, the present Dehra Dun Tea Company, comprising Hurbanswala (formerly the North-West Tea Company's garden) and Arcadia, both then gardens several years old, was started. It was originally under the same Calcutta direction as the now defunct Central Assam Company, whose gardens are still flourishing under the management of the Land Mortgage Bank. This Dehra Dun Company has passed through many vicissitudes and changes of management, and at one time it came near to share the fate of the Central Assam Company, its shares being quoted at a discount of 97 per cent But it pulled through somehow; and now, with a local board of direction, and two thoroughly practical and experienced planters as managers, its gardens are undoubtedly the best in the Dun, as the tabular statement (II) clearly shows.

In 1867 the Kaulaghur plantation was sold by Government to the Rajah of Sirmoor for two lakhs of rupees, and it has now developed into a valuable property, which well repays the purchaser, giving him a gross yearly income of over half a lakh of rupees, excluding working expenses. In 1832 Dr. Jameson estimated the area under tea at 2,500 acres, and in 1864 it was put down in Mr. Daniell's settlement report at about 1,700 acres; but these figures are in neither case very reliable.

PRESENT AREA AND OUTTURN.

In 1872 the Government called for returns regarding the area and outturn of tea in the Dun, but the figures arrived at by them differ considerable from the result obtained by Mr. Williams, the Assistant Superintendent of the Dun, in 1871, who, at the request of the Secretary of the Board of Revenue, N.-W Provinces, made careful personal enquiry into the matter. The figures accepted by the Government were as follows :—Area, 1,801 acres. Outturn, 411,548lbs. Average per acre, 228·5lbs.; while Williams gives a larger area, but a much smaller produce, viz :—Area, 2,024 acres. Outturn, 297,828lbs. Average per acre, 142lbs. The latter figures are probably the nearer approach to the truth; although, as will be seen from Mr Williams's return, which is appended, the outturn is not in all cases for the same year; in some places the produce for 1870 being given, and in others that for 1871. Moreover, in most cases the figures are only estimated, the exact actual outturn being given for only one or two gardens.

However, this statement being the result of personal enquiry, and agreeing so closely in total, if not in detail, with the area of old tea given in statement (II) for 1877, it is probably correct as to area, and not far out as to outturn; though the average per acre is much smaller than that arrived at by the Government return, and also than the present average. Mr. Williams seems to have been impressed by Dr. Jameson's estimate of 100lbs. per acre, which was, as has been shown, far too small.

(I.) Abstract of Mr. Williams's Return of Tea in the Dun in 1870-71.

Name of Plantation.		Area in Acres.	Outturn in lbs.	Remarks.
Dehra Dun Co.	...	550	130,000	For 1871.
Annefield ...	...	300	50,000	
Banjarawala	...	100	5,061	For 1870. Approximate figures only.
Lakhanwala	...	50	1,048	Do. do.
Kaulaghur ...	...	250	51,026	Exact outturn.
Goodrich Gardens	...	82	6,210	For 1871.
West Hope Town	...	68	10,000	
Naranjaupur	...	80	4,800	For 1870. Irrigated by canal.
Ambaree ...	...	170	13,000	For 1870.
Rose Villa (or Hurawala)		48	3,000	
Charleville ..	...	76	4,000	Under native management. Approximate figures for 1870.
Harbajwala ...	..	110	9,000	Under native management.
Garhi ...	...	30	2,200	Do. do.
Dartawala and Ambiwala		17	800	Do. do.
Nathanpur ...	...	15	450	Do. do.
Doom Singh's Garden, ...		59	8,000	Do. do
Kanya Lall's	...	19	1,000	Do. do.
Acres	...	2,024	297,828	

(II.) Statement of Area under Tea, and Outturn for 1877.

Name of Plantation.	Area under Tea. Old Tea.	Young Tea.	New Tea not bearing.	Total Area.	Outturn in lbs.	
Ambari	170	..	30	200	37,500	
Annefield	285	30	..	315	100,000	*
Jiwangarh and Rambagh	40	100	50	190	10,000	
W. Hope Town Co. ..	80	160	..	240	25,000	*
Lakhanwala	35	..	..	35	6,000	*a
Goodrich Gardens ..	107	206	...	313	40,000	*
Hurrawala	60	..	..	60	10,000	*
Arcadia	261	18	..	279	103,680	b
Hurbanswalla ..	318	..	56	374	139,750	b
C. Hope Town ..	..	4	90	94	1,000	b
Naranjanpur	125	..	40	165	25,000	*
Kanya Lall's	20	..	..	20	2,100	a
Harbajwala	75	..	..	75	12,000	*a
Doom Sing's	50	..	..	50	7,500	*a
Ramnath's	45	..	..	45	6,500	*a
Kaulaghur	300	..	30	330	70,000	c
Mulakawala	45	..	..	45	7,880	c
Banjarawala	71	..	..	71	18,530	
Nathanpur	25	..	..	25	2,000	a
Total ..	2,1 12	518	296	2,926	624,360	

Remarks :—(a) Native management ; (b) Dehra Dun Tea Co. ; (c) Rajah of Sirmoor's Gardens.

The above tabulated statement (II.) shows that the area bearing tea in 1877 was 2,630 acres, and the total produce was 624,360lbs., giving an average over all of 233lbs. per acre. It will be noted, however that in the 2,630 acres are included 518 acres of young tea, mostly only four or five years old, which is of course only very lightly plucked and therefore contributes to the average outturn only to lower it. It would have been more accurate to have separated the produce of the young tea from the old, and thus have obtained a better idea of the average outturn of tea in full bearing in the Dun ; but for obvious reasons this was impracticable.

But the foregoing statement does not exhibit all the land under tea. During the last two years tea enterprise has made rapid strides · several new gardens have been commenced, and a considerable area has been and is still being, brought under cultivation. The following statement shows, in addition to the 296 acres of new tea on the old plantations, the area under plant in the gardens, also the estimated extensions both on these and on some of the old plantations In addition to the items noted in statement (III.), it is probable that there may be other extensions, both in existence and in contemplation, as it is more difficult to obtain reliable statistics on this point than on any other Moreover, it is impossible to say what new enterprises may not be started within the next year or two, now that the Eastern Dun is being opened out. All the new gardens are in the Eastern Dun One of them, Dhoiwala, formerly had a considerable area under young tea, but it was rooted out and destroyed, or allowed to die out, to give place to the cultivation of rhea grass—a speculation which, unfortunately, resulted in failure ; and the new proprietors of the grant are now reverting to tea again.

(III.) Statement of Extension, and New Gardens, 1877-78.

Name of Garden.	Area under Plant.	Estimated Extention within a year or two.	Remarks.
Goodrich Gardens ...	...	500	Seed beds planted out for this area } Old Gardens
E. Hope Town ...	...	[illegible]	
Balawala	10	[illegible]	
No. 8 Grant	15	185	
Chapori	70	50	
Gorakhpur	21	71	
Khanwala	14	186	
Dhoiwala	25	75	
Sundry small gardens ...	80	...	Mostly small patch of Tea in and above Dehra itself.
Area brought forward...	296	...	From Statement II.
Total ...	531	1,217	

The total area of land at present under tea in the Dun is therefore about 3,160 acres ; and there is little doubt that within the next two or three years it will amount to fully 5,000 acres as extensions which will bring it up to 4,378 acres, are already in contemplation ; while it is probable that new ventures may be opened out ere long. Assuming Mr. Williams's figures for 1870-71 to be correct, the area of tea cultivation in the Dun has increased by more than thousand acres during the last five or six years, while the tea produced has more than doubled itself during the same period.

The average outturn per acre of seven of the different gardens is given below, only those gardens being selected whose area and produce, as given in statement (II.), is known to be absolutely correct.

		lbs.	
1.	Hurbanswala ...	440	Dehra Doon Co.
2.	Arcadia	397	
3.	Bangarawala ...	260	Private.
4.	Kaulaghur	233	Rajah of Sirmoor.
5.	Ambaki	220	Private Company.
6.	Maulakawala ...	173	Native management.
7.	Nathanpur	80	Do. do.

The Dehra Dun Tea Co. *facilis princeps*, head the list, completely distancing all competitors. This is mainly owing to careful cultivation and manuring, an admirable system of pruning and to the absence of all irrigation, from the canals ; which irrigation, owing to the large quantity of lime held in solution in the water is now almost universally acknowledged to be eminently injurious. In Hurbanswala, in particular, which, after Kaulaghur is one of the oldest gardens in the Dun, the bushes are fine as can be seen in any part of India, are totally different from the stunted and miserable specimens to be seen in many of the small gardens.

CULTIVATION, MANUFACTURE, LABOUR, AND GENERAL REMARKS.

There appear to be certain differences of opinion on several points connected with the cultivation of tea, as regards the best method of sowing nurseries, transplanting, pruning, and as to whether irrigation is or is not beneficial. A few nurseries have been sown under the artificial shade of grass *tatties*, which are placed over the young seedlings whenever the sun is at all powerful. The general opinion is decidedly against this practice, as tending to make the seedlings delicate and sickly ; most planters put out their seedlings in the open, and without any artificial irrigation. One experienced planter says :—" Our seed-beds are not irrigated at all, and are not put out under the shade of trees, for they are found to do best when in the open plain. Even in 1877, the driest year known in the Dun for 100 years, the seedlings grew well without water in the open plain." Transplanting from nurseries to fill up vacancies, and to plant out extensions, is generally carried out during the rains, a considerable quantity of moisture in the soil being needed to cause the young plant to take kindly to its new locality ; while the general opinion seems to be against artificial irrigation, in this as in all other cases. Artifical irrigation, particularly from the, canals, seems to be almost universally condemned, as not only of no benefit but as absolutely injurious, and in many cases fatal to the tea plants, whether young or old. In the Hurbanswala Garden, patches of vacancies occur which it seems impossible to fill up. The ground has been well manured, and seedlings have been planted out in these vacancies, and tended most carefully, but they never thrive, and eventually die out again. These sterile patches invariably exist on the banks of old *kuls* or minor irrigation channels, leading from the canal ; and the manager of the Hurbanswala Garden, one of the best and most experienced planters in the Dun, is of opinion that the unconquerable sterility of these patches is due to the former thorough saturation of the soil with canal water The destructive effect of this water is attributed to the enormous quantities of lime held in solution by it. The hills north of Dehra being generally of limestone formation, and some of the streams which feed the canal being so strongly impregnated with lime that it is impossible to boil pulse in their waters, a few drops of which will curdle milk, it may readily be conceded that these waters are not likely to have a beneficial and fertilizing effect. On the subject of irrigation, the planter before quoted, writes :—" The Goodrich plantations were once under irrigation, and there were 15,000 vacancies. Of these, some 30,000 have been recovered by giving up irrigation, and by careful hoeing vacancies have spontaneously filled themselves up after a disappearance for three years. . . . . . . Wherever the canal water had been run into the tea, the plants have died out, chilled by the water "

Canal irrigation being so injurious, and well irrigation, from the nature of the locality, being practically out of the question, it follows that the planter must depend entirely upon the rainfall. When this is up to the average and fairly distributed over the season, without any long intervening spaces of dry scorching weather, a first class outturn may be anticipated. Even if the rainfall be considerably below the average, and yet the showers recur at comparatively short intervals, a good outturn may be expected. Last year, 1877, the rainfall was very scanty, but what little there was was well distributed over the season ; so that with careful cultivation and good management, several of the gardens turned out the largest average outturn per acre they had ever done ; Hurbanswala giving 440lbs. per acre. In 1873 the total amount of rain was rather above than below the average, but the rains were very late in setting in, very heavy when they did come, and the preliminary hot weather very severe, the result being a very poor outturn of tea ; the above named garden giving only 190lbs per acre.

The number of flushes of leaf in the year is naturally an uncertain quantity some consider that there are only three or four distinct flushes, but such flushes stand more than one plucking. In Assam, a flush every ten days or a fortnight, in the height of the season, is no unusual thing, necessitating a considerable increase in the temporary labour devoted to plucking, to get round the garden before the flush gets hard on *banji* ; and in a very good year in the Dun, somewhat similar flushes, though less rapid in their reappearance, keep the manufacture going on almost uninterruptedly from Apirl till October. But in an average year, there is a distinct break between April and June, of duration varying with the date of the setting in of the rains, in which no leaf is available for plucknig. As a rule, plucking commences towards the end of March, and the first flush is exhausted and the "spring crop" gathered in by the middle of April. This year most of the gardens and commenced manufacturing, and made several thousand pounds of tea before the end of March. Plucking begins again in June-July, according to the setting in of the regular rains, and continues, with an occasional break, varying in date and duration according to the rainfall, until the end of October or beginning of November. The average number of plucking days throughout the year is about 120.

Pruning is carried on at various times, the "tipping" of the upper shoots being generally done as soon as the sap has fairly descended, about December and January. Advantage is taken of the break after the spring crop is got in, to clean out the bushes by cutting out dry and heavy wood from them so as to give room and air to the greener and more prolific branches. Various opinions obtain as to the best methods of pruning ; the most generally received and successful has been indicated.

The Dehra Dun Tea Company and some of the other gardens also go in steadily for manuring, making it a rule to get round the whole garden at least once in three years. Ordinary cattle manure is generally procurable from surrounding villages at about 10 or 12 cartloads per rupee, and from

The labour question, so complicated in Assam and other tea-growing countries dependent on imported labour, is here a simple matter. As a rule, local labour is obtainable in any quantity, though the labour-market varies to a certain extent inversely with the grain market, coolies being more readily procurable in a year when high prices prevail than in a year of plenty. The average wages are Rs. 4-8 per mensem to *beldars*, and Rs. 5 to tea-makers; leaf-plucking being paid for by contract rates at so much per seer, the fluctuating demand for this class of labour being supplied by the women and children of neighbouring villages. Imported labour, or coolies, serving under agreement or contract for a fixed period, are unknown and unneeded in the Dun.

The manufacture is, of course, much the same process as elsewhere. Little or no machinery is used, the rolling being done entirely by hand, and the panning and drying off in the usual manner. The Dehra Dun Company have lately got up from Roorkee a new cylindrical revolving drying machine, the tea being enclosed in wire cages within this long cylinder, and kept revolving while blasts of hot air are driven through; but the machine has not yet been practically tested.

A good deal of green tea used to be manufactured and sold locally to Cabulee and other trans-frontier merchants, who came to the factories and took over the tea in bulk packing it into their own bags, and carting it off at their own expense. This was a very profitable method of disposing of the produce of the gardens, as packing and freight charges were saved; but from various causes, partly political and partly local, carelessness, and competition elsewhere, this demand gradually declined, and has now ceased altogether. Very little green tea is now made in the Dun, probably not more than 15,000lbs; and the bulk of the outturn of all classes of tea is packed and transmitted to Calcutta, either for sale there or for shipment to England. A small quantity of tea is offered for sale occasionally at the general auctions in Mussoorie, and some comparatively large parcels are bought up by a local firm, Messrs. Buckle and Company, for retail sale; but as compared with the total outturn of over six lakhs of pounds, the local sale, since the loss of the Cabul and trans-frontier custom, is comparatively small.

The class of plant in the Dun is principally China and hybrid, with a close assimilation to China. Of Assam hybrid there is very little, and of the pure Assam variety but one or two isolated specimens. The Assam and Assam hybrid are both far too delicate plants to withstand the hard climate and winter frosts of the Dun; and there can be little doubt that the larger and softer-leaved varieties of the tea plant are unsuited to the Dun, while the hardier China and China hybrid, though less productive in softer and milder climates, are best suited to the northern sub-Himalayan tracts. As regards quality, the Dun teas, like most Himalayan teas, are as a rule superior in delicacy of aroma and flavour to those of Assam and Cachar, though inferior in strength; and may be classed with the Kumaon and Kangra Valley teas.

COFFEE.

LIBERIAN COFFEE shares the peculiarity of the tea plant, in sending a tap root into the subsoil; and in selecting sites for planting this variety, special attention should therefore be given to the subsoil, which should be porous; localities with stiff clayey subsoils should be avoided. *Coffea Arabica* is to a great extent a surface-feeder.

M. J. LAPEYRERE, Pharmacien de la première classe de la Marine, has written to the Viceroy, offering to visit India and study on the spot, the disease which rages on the coffee plantations. The local Government have communicated the contents of M. Lapeyrere's letter to the Commissioners of the Ashtagram and Nagar divisions and the Superintendent of Coorg, and asked whether the Planters' Associations will be willing to accept M. Lapeyrere's services, and pay all the expenses. We doubt if any advantage would accrue from accepting this gentleman's proposal, and the Government of India will probably decline it with thanks.

NUMEROUS inquiries reach us as to the most suitable climate for Liberian coffee. The best information within our reach seems to prove that the climate of Liberia very closely resembles that of Wynaad, and other places on the western side of the South India "ghauts," where the tremendous rainfall of a couple of hundreds of inches in from four to five months of the year is followed by drought intense in proportion It is probable therefore that this species of coffee will well bear the extremes of climate in portions of South India and Ceylon; while it will be found to flourish even more than in its native habitat, in positions where fairly good soil is supplemented with heat, which is almost always a *moist* heat, from the prevalence of copious and well-distributed rainfall.

We should advise Assam and Cachar planters to try this species in sheltered situations.

PROSPECTS of the coming coffee season in Ceylon continue good, and are raising the spirits of planters, which until lately were somewhat drooping, owing to anxiety on the subject of increased expenditure on estates and of crop prospects. We are indebted, says the *Ceylon Observer*, to a gentleman who has lately made a tour through many of the most important planting districts of the Island for some information on the subject, and we gather from his account that prospects generally were seldom so bright. All the blossom which whitened the coffee fields during last month, has set most favourably, and the young berries which have succeeded it, look healthy. The weather has also been so far very advantageous, but rain will be soon necessary in the majority of districts. A fine promise of blossom for April, is to be seen on the majority of estates, while in those districts which have the Uva climate it is even now on the trees. When the time arrives for making coffee estimates, we shall be able, we hope, to report that the latter are exceptionally large, even for a "good year." Tea, Liberian coffee, and cinchona are generally reported on favourably, as are also the promise of purely native cultivations. The cocoa in Dumbera also looks well, but a protracted drought is seriously affecting all products in that district.

With reference to the probable hybridization between *Coffea Arabica* and *Coffea Liberica*, which we noted in our last issue, we hear now that experiments were carried on at the Ceylon Royal Botanic Gardens, Peradeniya, to produce such hybrids, nearly two months ago. Plants of Liberian coffee were crossed by pollen from the ordinary coffee, but though three distinct trials were made, no results were obtained: the ovaries of the Liberian coffee were not fertilized, and no berries were produced. Possibly this may have arisen, as Dr. Thwaites suggests, by the pollen grains of *Coffee Arabica* being too small to fertilize the ovules of the much larger kind, *Coffee Liberica*. The crossing of plants of *Coffee Arabica* by pollen from *Coffee Liberica* may be attended with better success, but it is very much doubted whether the hybrids thus produced, will possess any qualities superior to those possessed by either of the two species now under cultivation. The hybridising of the two species naturally, when cultivated in approximate areas, is not very probable. The flowers do not appear at the same time—at least they do not at Peradeniya—and the very short time during which the pollen is effective, very much lessens their chances of hybridizing. As a scientific as well as a commercial question of some interest, the matter, we are informed, will be still further examined, and at some future date we hope to lay the results before our readers.

THE best remedy against the 'borer' attacking coffee plantations, is said to be providing for it bamboo plantations. A correspondent writes on this subject.—"The borer loves the bamboo, and no sooner does the rising generation of bamboo, attain any considerable size, than away go the myriads of borers, to their natural home and food, leaving the coffee plant to flourish. The planters may now rely upon the bamboo for thirty years to come, during which time planters may expect fair seasons, and it is to be hoped that during that time some means will be devised to protect themselves against, if not to prevent, the disforesting of the hills. When the bamboo is realised as a double blessing—getting rid of the borer, and bringing back the showers—all that can be learnt about it, is well worth studying.

"I will add a few words on manuring. When coffee-planting was first introduced into India, there was a notion that it would turn out a better occupation than shaking the Pagoda tree. Three years of it, it was thought, would make a fortune. Experience soon showed, however, that coffee is a most exhausting crop, and an estate to be profitable requires an abundance of manure. Planters have learnt this by experience, and they have also learnt that the best manure at present known is that of cattle. Unfortunately, cattle in any considerable quantity are not wanted in the coffee districts for purposes of draught, and still fewer are wanted for beef; so that a coffee estate has to be burdened with a large stock of cattle passing their time, as a peculiar epitaph in CARLYLE'S *Sartor Resartus* tells us "Zachdarm the Great" spent his days. Here, then, is another point worthy the consideration of the planters. It is a great pity that so much power and material should be living "duly sluggardized" on the hills; and the question of scientific manuring should attract the attention of the coffee grower."

THE SETTING OF COFFEE BLOSSOM BY IRRIGATION.

THE *South of India Observer* says:—We have this day received from one of our planting friends, a sprig of a coffee bush, some half a yard long, and laden, small as it is, with numerous clusters of well-developed and solidly-formed coffee berries of the size of large English peas. Our friend further informs us, that this sprig is but a small and poor sample of one bush of many tons of acres of coffee on this estate, which, since the middle of December last, have not known or seen one drop of heaven's rain, and therefore the existing and happy results (of which the specimen now before us is one) are mainly, nay, entirely due to the blessings and benefits of *irrigation*—annually commenced about the beginning of February, and the system of which has been carried out on this estate since it was first opened some sixteen years ago, and with what satisfactory results is best known to the proprietors. This one fact should be a most convincing proof to the most sceptical and prejudiced of our Wynaad planters (and their name is legion) as to the practicability and advantages that ensue from application, as far as it lies in their power of *irrigation*. This little sprig tells its own tale, and conveys lessons and experiences which should not be allowed to pass away unheeded.

COFFEE IN AMERICA.

THE Department of Agriculture at Washington, has issued a circular relative to the possibilities of the cultivation of coffee in the United States. It appears that the conditions of latitude, climate, and soil of a part of the United States lead to the conclusion that the coffee plant or tree can be cultivated to some extent in that country with successful results. The total importation of coffee into the United States in 1876 amounted to 339,789,246lbs., and cost 56,788,997 dols. It has been established by the best authorities on the subject, that great warmth of climate is not absolutely essential to the growth of the coffee plant, but a climate characterised by neither extreme heat or cold, and possessing a fair amount of humidity. The climate and soil of Florida, there is every reason to believe, would answer these conditions. So it is also with lower California and a portion of Texas. This belief is rendered almost a certainty by the authentic statements that in these regions, at least in Florida and California, there is found growing in abundance a wild coffee plant with many of the characteristics of the cultivated plant. In California the experiment has been tried of planting the berry of coffee obtained from Costa Rica, and the results are reported as satisfactory. The Department of Agriculture proposes to investigate further the conditions of soil and climate essential to the growth of the coffee plant, and invites information or suggestions on the subject.

LIBERIAN COFFEE.

FROM the most recent information on this new species of coffee, it would appear that it is likely to flourish from sea level up to 1,500 to 2,000 feet, and Mr. Agar is even confident that the plants will bear fruit at an altitude of 3,000 feet above sea level, which however is still only an opinion that requires confirmation. Mr. Agar writes on this subject to the *Ceylon Observer* :—

Dickapittia, Lemastota, 16th March 1878.

"I now place before you a few of my ideas regarding Liberian coffee, and you can make any use you like of the information.

A few trees grown from seed sent to me from Liberia by my father-in-law, the late Mr. G. A. Cruwell, planted near this bungalow, at an elevation of 2,800 to 2,900 ft. above sea level, seem to grow rapidly, and have attained a height of 3 ft. 6 inches in two years, with 6 pairs of primaries and leaves of 12 by 4 inches. The seed was planted by me nearly two years ago, and I look forward to a small blossom coming out next month. Those few plants kept here bear a favourable comparison with those planted, most carefully, by Mr. Cruwell at Wellawaya, 400 feet above sea level. Though the Wellawaya trees are a little further advanced in height, and have blossomed a month ago, I do not despair of Liberian coffee trees at 2,800 feet elevation giving as much crop and making as fine trees in a few years' time. Our *Coffea Arabica* does not come into full bearing in Haputale at an altitude of 5,000 feet before seven to eight years ; consequently I think the *Liberica* will take longer to mature at 2,800 feet, or even say as low as 1,500 to 2,000 feet, than on the banks of a hot, steamy river in the low country.

When in Liberia I had no way of judging whether coffee grown at an elevation was equal to the low flat country sample, as the Liberians have not yet arrived at a pitch of enterprise sufficient to carry them a hundred miles island. One Liberian gentleman, a Dr. Dunbar, told me that he owned about a thousand acres somewhere in the interior, and wished very much that I would join him in opening it up, as he felt certain that the coffee would do better on the hill-sides than on the low-lying, swampy river banks, and I told him that I thought so too, and that in Ceylon we always cultivated our estates on the hill sides.

Of course one cannot judge of the whole island by the district of Haputal ; each district is different, and must be taken as one finds it ; but in Haputale I look forward to seeing Liberian coffee grown at an elevation from, say, 2,500 feet to 3,000 feet, and paying handsomely.

As regards leaf-disease, I am inclined to think that Liberian coffee resists its attacks better than our ordinary Arabian coffee. Whether this may arise from greater care having been taken of so precious a plant, or whether its innate stamina is greater, and better able to cope with the pest, we must leave for a few years to decide ; as it is only when coffee has to bear crop that one can really test its enduring qualities. Some yellow-spotted leaves I sent to Dr. Hooker from Liberia for microscopical examination fancying that they might be affected by a close ally of the *Hemilia vastatrix*, but he pronounced the spots on them to be caused by a common tropical grub, and found no sign of our leaf-disease on them.

THE COFFEE TRADE IN 1877.

THE ample though by no means excessive supplies, that have been imported into Europe during the past year, have on the whole been readily absorbed by the trade, and although, owing to the unsatisfactory state of business all over Europe, and the distress caused by the Eastern War, deliveries are considerably smaller than during the past few years, the stocks in the principal European ports on 31st ultimo do not show any great increase over the reduced supplies left at the close of 1876, whilst they are actually smaller than two years ago. The two countries from which the greatest increase was expected, have fully realized the figures put forward last year, Ceylon having exported 47,000 tons against 36,000 tons during the season 1875-76, whilst the Java crop has reached the large total of 1,286,000 bags Government, and 240,000 bags private coffee, or 54,000 tons in excess of the previous season. From Costa Rica, Guatemala, and Central America we have received an excess of 5,060 tons over 1876. On the other hand, the Rio crop finishing 30th June last has only given a total export of 159,300 tons, of which 63,000 tons came to Europe, against 61,700 tons the previous season. Of the present Rio crop, 78,500 tons had been shipped from 1st July to the 30th November, of which only 21,500 to Europe, and the total export to 30th June 1878 is still estimated to reach about 2¾ million bags, or about 165,000 tons, whilst the new crop is reported to be very promising. Santos exported 36,700 tons during the season finishing 30th June 1877, and the crop now in course of shipment is said to reach fully 50,000 tons, of which 19,000 tons had been shipped to end of November. The new Ceylon crop is being rapidly forwarded, 8,500 tons having been exported since the 1st October last, against 5,240. According to latest accounts the estimates have again been reduced from 30,000 to 25,000 tons. The Java crop of 1877 has given a total of 898,000 bags Government, and about 180,000 bags private, or rather more than the estimates current in the spring, but the new crop is said to have suffered severely from the protracted drought, and has only been saved from complete failure by the timely rains which have fallen since the beginning of December. From the Costa Rica and Central America crop accounts are unfavorable, and we cannot expect anything like the large imports of the past year ; whilst St. Domingo is giving a large crop. The imports from Southern India have only reached 8,000 tons, against 9,000 tons in 1876, and from all accounts the coming season will not give us any material increase. The abnormal seasons in India and Ceylon have told adversely upon many estates already weakened by the ravages of the leaf disease ; and although the serious falling off in the supply of colory plantation coffee, which we must experience in the present year, cannot fail to influence prices of these descriptions, it is a matter for great regret that the prospects are not more satisfactory, not only for those directly interested, but also for the market in general. The short supply of 1876 caused an advance in the price of middling Ceylon to 118s early in January last, which disturbed the market for the following three months. With heavy imports and bad deliveries, prices gradually receded until 99s to 98s was touched at the end of April. From that time prices recovered almost uninterruptedly until 110s was again reached in September, to declare again to 105s during October and November, the market closing quietly for all descriptions, except fine colory new crop Ceylon, which is realizing comparatively high rates. The fluctuations in good ordinary Native Ceylon have been much smaller, the market opening at 89s and closing at about 86s, after touching 81s in April last. Fine home trade East India, Neilgherry, Coorg, and Mysore have realized extreme prices, but have been quite neglected later in the year ; pale descriptions, such as good ordinary Jamaica, ordinary Guatemala, and Manilla, are from 4s to 8s lower than a year ago ; whilst Rio shows but little variation. Mocha with larger imports than for several years has only been saleable at very moderate prices, closing at 99s to 104s for common to middling.

The total deliveries in Holland are about equal to last year, and comprise 78,500 tons, against 80 000 tons in 1876 ; prices have fluctuated between 50 and 54 cents for good ordinary Java, and have generally ruled slightly below the competing descriptions in our own market ; the London deliveries show a falling off of 3,000 tons and the imports an increase of 12,000 tons as compared with 1876, leaving stock of 14,000 tons against only 6,800 tons a year ago ; whilst United States held a stock on 1st December 1877 of 11,000 tons against only 3,500 on 1st December 1876 ; deliveries in America are fully equal to those of the previous year.

The deliveries for consumption from the principal European entrepots showed a falling off on 1st ultimo of about 43,000 tons, being only 290,000 tons for 11 months, against 333,000 tons in 11 months of 1876. No doubt the great restriction of credit caused by the outbreak of the war in April, and the general contraction of mercantile operations, has interfered with the distribution of coffee all over Europe, and the extremely small stock held everywhere, owing to the strict hand-to-mouth nature of business during the past year, will have to be taken into account in considering the prospects for the present year. With the improved state of things in France, where deliveries have shown the greatest falling off, an early termination of the war would lead to a strong revival in the demand, whilst in the second half of 1878 the question of short supply will materially affect the statistical position of the article.

RULES FOR WORKING A COFFEE ESTATE.

THE following rules for the guidance of the Assistant in charge of a large Coffee Estate, which were drawn up by the proprietor who had had charge of his own property, may interest some of our readers :—

THE CLEANLINESS OF THE ESTATE.

The cleanliness of the estate must be particularly attended to. If possible, there should not be less than nine weedings in the year. At present the estate is unavoidably weedy, the whole of the labour being engaged in gathering the crop. In weeding, the coolies will be tasked ; Mr. —— using his own judgment, as to the amount of work to be done by each cooly.

TRENCHING.

Twelve or more men are to be constantly kept at this important work. The task hitherto has been forty-five trees per diem for each man, but where the root grass is at all abundant, the number of trees may be reduced, to enable the men to be careful in removing as much of the grass as possible. The trees show the effect of trenching when the latter has been done during the dry season. For this reason, the dry weather must be taken advantage of.

IRRIGATION

Requires much judgment, too much water being as evil in its consequences as none at all. The water channels, especially the main one, running along the top of the estate, should always be kept perfectly clear from weeds, drift, and silt, as these with crabholes cause percolation, which, if allowed to continue for any length of time, creates swamps which naturally will greatly injure the trees. Where blossom has been brought out by irrigation, it must be kept up, until the fruit is well set. Every drop of water must be turned out of the river during the dry weather, and none wasted.

MANURE.

Such protions of the estate which were not manured during the past year must be done this year, of course to such an extent as manure is available. As much must be purchased as can be. The carts can be employed during the dry weather in collecting it.

DRAINS.

All portions of the estate having a tendency to over-moisture, must be drained, the present drains to be always kept well open.

NURSERIES

To be carefully planted and shaded.

PULPING HOUSE AND STORES.

Be careful before setting the wheel to work, that the pulper is properly set, and everything in its proper place, the lubricating holes well filled with oil, and the cog wheels greased. The pulper must not be worked at a greater speed than seventy bushels per hour. At this rate, the water wheel ought not to make more than nine revolutions per minute. Parchment coffee should not be stored, without being exposed to a bright sun for less than four days. Should the weather be cloudy, a longer period for drying will be required. Before despatching the pounded coffee to Bangalore, see that it is well sifted and perfectly free from black and discolored coffee.

BUILDINGS

To be kept in order and good repair. The lines to be kept clean, all ashes and refuse to be deposited in the manure pit.

CATTLE

To be carefully attended to, and stock taken once every month. Working bullocks to be supplied with grass at night.

PRUNING.

The old coffee to be carefully knife-pruned ; all suckers, dead, and whippy wood, to be removed, the younger trees to be moderately handled.

THE COOLIES.

The welfare of the people must be particularly attended to. Every lawful indulgence (consistent with good order and discipline) is to be allowed them. *Striking* the coolies *is strictly prohibited.* I have always found that abusive language, a harsh manner, and "licking" on the part of those in authority, always induce the people to discontentment, besides creating fear and disrespect towards their masters. If every one were to behave the reverse of the above towards their coolies, there would seldom be cause of complaint on either side. The sick should be well looked after and cared for, the lazy (if no improvement evinces itself after moderate fining) should be dismissed ; the willing worker and deserving should be further encouraged by kind words and appropriate rewards. My *maistries* have never given me cause to be annoyed with them. I trust they may continue to give satisfaction. A certian amount of respect is due to them ; for, if they are not respected by their master, they will not be respected by their men.

MISCELLANEOUS.

Sunday work must be strictly avoided, except when actually compulsory ; such as watching and washing coffee, &c., during the crop season.

Fire must be guarded against during the dry season, fire-paths must be cleared all round the estate, especially about the lines and other buildings. All trees having the appearance of being attacked by the borer, must be immediately removed and burnt. After crop, the pulper to be taken to pieces and cleaned. All troughing, tubs, machines, &c., to be placed beyond reach of white-ants. The distribution of labour and weekly reports to be punctually delivered.

COORG SEASON REPORT FOR THE SECOND SEMESTER, 1877.

THE following interesting report has been sent by Mr. Richter to the *Madras Agri-Horticultural Society* :—

The principal agricultural operations of the past season being nearly over, it is not difficult to gain a general view of results in Coorg, and it is to me a great satisfaction to be able to report that whilst unfortunately the crops in the adjoining province of Mysore have remained far behind expectations, the harvest from wet and dry cultivation, the mainstay of the Coorg farmer, has been excellent, and almost equally good throughout this country. The ryots from different talaqs affirm that for years the rice crops have not been so plentiful and heavy, and to crown the blessing the weather during harvest time proved all that could be desired. These happy circumstances already tell on the market rates : rice sells now at 9, horse gram at 10, and ragi at 12 seers for one rupee—an improvement by one-third on the rates a few weeks ago.

It would give me great pleasure if I could also report a bumper coffee crop ; but alas our "hopes revived" in the first quarter of the season, have again been disappointed, and the year 1817 follows suit in its character regarding coffee industry to that of its predecessor. Almost everywhere in Coorg, the outturn fell miserably short of the estimates based on the fair appearance of the blossom. But in a famine year, unparalleled in the annals of Southern India, one had to prepare for disappointment and loss also in cultivation. The monsoon, though on the whole copious, amounting in Mercara to 8 inches fallen during 162 rainy days, was somewhat out of time. In July, when, in the ordinary course of the monsoon, the heaviest rainfall occurs, *viz.*, an average of 43 inches, we had only 14 inches, with but 25 inches in June and 30 inches in August, and in the Bambu district the shortcoming of July was still more marked and injuriously felt, the rainfall amounting to but 4 inches!

It appears that the coffee tree, laden with fruit in its first stage of formation, requires a rich and continuous flow of sap engendered by incessant moisture in the ground and atmosphere ; and a sudden stop of rain and a long-continued break with a bright sky and a hot July sun check the healthy growth of the incipient berries, and cause either malformation of many or a large percentage of droppings. In the struggle for existence of her products, Nature relieves herself of what she is unable to sustain. Where the planter, with the eye on the blossom and the first set of berries, estimated a quarter or half a ton per acre, Dame Nature reversed his calculations by adapting herself to climatic circumstances, without any regard to his balance sheet with his banker. But as there is no unmitigated evil in this world, the very loss of crop has been a gain to the coffee trees which, relieved by Nature's pruning, burst out with renewed energy into a luxuriance of new wood and foliage, so that prospects for the coming crops are everywhere most hopeful. Will the year 1878 bring the long-looked for bumper crop? We sincerely wish it, for the Coorg planters deserve it.

The continuance of distress in Mysore, has somewhat relieved the planter's apprehension of a great impending scarcity of labor. The coolies live on the estates more comfortably than in their famine-stricken homes, and they prefer estate to relief work.

I beg to offer to the Committee my best thanks for the seeds received. They all proved of excellent quality. I look forward with pleasure to the receipt of any contribution from the Society for my experimental garden, and am especially anxious to try the Ipecacuanha.

Table of Rainfall.

MONTHS.	1875.		1876.		1877.	
	Mercara.	Bambu.	Mercara.	Bambu.	Mercara.	Bambu.
July ...	39·07	17·52	52·40	25·20	14·31	4·85
August ...	18·58	6·97	26·85	10·57	30·59	8·01
September ...	8·15	4·29	6·92	4·59	18·78	10·70
October ...	8·31	3·05	1·61	1·58	11·76	10·28
November ...	0·19	0·96	0·29	0·15	0·79	6·80
December ...	0·48	0·40	0·00	0·00	1·79	0·00
Total ...	69·78	33·82	87·97	42·09	77·97	42·14
Previous Semester ...	24·88	25·87	20·72	16·40	33·30	25·86
Grand total for the year ...	94·66	59·69	108·69	58·49	111·27	68·00

G. RICHTER.

JAVA COFFEE.

MR. F. W. DITMAS, Honorary Secretary, Planters' Association of North Wynaad, writes to the Madras Agricultural Society, under date Manantoddi, 11th February 1878 :—

With reference to your enquiry regarding the Java coffee plants, the seed of which your Society procured for this Association in 1875, I am sorry to say that I am only able to give you a very meagre account of them.

1. The seed when received was nearly all more or less eaten by small insects, the result of being packed in green bamboos and moss.

2. The number of plants raised were as follows, *viz.*, :—

Moka Cesar ...	11	Kotjel ...	19
Waranga Kadoe ...	17	Aden ...	20
Coffea angustifolia ...	19	One-seeded Menado ...	26
Coffea Mauritiana ...	16		

or say in all 128 plants. These were distributed amongst six of the Members of the Association, of whom one has since died and two are now in England. I have, however, received reports from four of our Members who received them, though I am sorry to say two of them are merely to the effect that the plants had been lost sight of by having been mixed up with the ordinary Wynaad plants either in the nurseries or when planting out in the field. Of the other two, Mr. Lowrie says :—

"Of the 19 plants received, 7 died in the nursery, the remaining 12 have made excellent growth since their transfer to the open, and about 5 plants of the Coffea Mauritiana have flowered, and have now very fair crop of berries on them; they resemble in appearance and growth the ordinary Wynaad coffee. The other variety (Ketjil or small Mocha), of which I have four plants, present rather a curious habit of growth, the primaries being short and upright, and the leaves very short and narrow, the old plant having rather a stunted and shrivelled appearance, while in the nurseries both varieties showed very slight symptoms of leaf disease, but since planted out in the open have been entirely free from it, although, strange to say, a batch of Liberian plants and the ordinary Wynaad coffee growing in close proximity have suffered considerably from the disease * * * * The five plants above mentioned are the only ones that have yet blossomed on the estate; the blossom was forced out early in April by irrigation before any other estates in the neighbourhood came into flower, so that the seed now on the trees should be very pure."

Mr. Dawson says :—

"The plants were planted out immediately after I received them in a fair average sample of virgin soil, and excepting that owing to their very small size (4-leaved seedlings), I had them watered several times during the dry weather, they were treated exactly as ordinary coffee plants. Two only of the plants have died, and the remainder have attained an average height of about 4 feet.

"One variety *(Coffea angustifolia)* much resembles the ordinary Wynaad coffee bush; perhaps if anything the spread of its branches is a trifle less, but this is made up for by the abundance of young wood already growing on the primary branches; the crop now on the trees is very small certainly, not averaging over one cwt. per acre.

"The other variety (Aden) is extremely like the tree known here as the 'chick;' several of these plants have grown to a height of two feet six inches without throwing out a branch, and when at last the branches do grow, they more resemble gormandising suckers than anything else; the variety indeed appears to be an aggravated chick of the lowest order. The greater number of these trees are not producing any crop; on two or three of them a few berries are growing. Twenty of these plants have died, and several I had to cut down on account of their top-heavy character.

"Both varieties are healthy and perfectly free from leaf disease."

3. Both Mr. Lawrie and Mr. Dawson had forgotten the name of the varieties sent them, but I was able to supply the omission from the records of the Association.

4. I trust that though the experiment does not at present promise any good result, this report may be of interest to your Society, to which the thanks of this Association are due for enabling us to carry out the experiment.

CINCHONA.

CINCHONA CULTIVATION IN THE UNITED STATES.—It appears from the report of the Commissioner of Agriculture that an attempt which has been made to introduce the cultivation of the cinchona into the United States, has not up to the present time turned out very favourably. During the past ten years, a continuous supply of young plants of several species of cinchona has been maintained by a yearly propagation of young plants, equal to the numbers distributed. Plants have been sent to California and to several of the Southern States, mainly to Florida. The reports that have reached the department, do not indicate success in their culture; owing to adverse climatic influences. Experiments show that none of the species will stand the slightest frost without injury, and even in the equable atmosphere of the greenhouse their vitality is impaired when the temperature is below 50°. Whether or not the climate conditions for the growth of cinchona exist in any portion of the United States is a question not yet solved; but so far as present knowledge warrants an opinion, further experiments should be confined to the locality of San Diege California, as offering greater promise of success than any other point.

MOSS FOR THE GOVERNMENT CINCHONA PLANTATIONS.

THE following letter has been addressed to our South of India contemporary by a planter :—

SIR,—There is a rumour afloat that the Superintendent of the Government Cinchona Estates is corresponding with the Nilgiri Forest Reservation Commissioners with a view to inducing them to reserve the whole of the Sholas between Sholoor and Makurty Peak, estimated at a total of some five thousand acres of land, for the purpose of furnishing a supply of moss sufficient for the requirement of the Government Cinchona Estates at Pykara and Neddivuttum. If there is any truth in this report, and the Forest Reservation Commissioners have received instructions from the Madras Government to seriously consider the application of the Superintendent of Government Cinchona Estates, with a view to granting it, a great injustice will be done to the planters who have settled in the vicinity of the district in which the Sholahs are to be reserved. Those planters who have recently purchased land near to the Government Cinchona Estates, have been induced to do so chiefly on account of the proved success of the Government gardens. In most cases they have applied for grass land and Sholah land separately, although both have been included within the same boundary. As a rule, after the usual great delay, the grass lands have been sold by auction and purchased by the original applicants, while the applications for Sholah lands have apparently been shelved. If now the Commissioners step in and reserve all or any of these Sholahs that have already been applied for, I think it will not be denied that we, the planters of this district, have just cause for complaining.

It is of course admitted by most people that Sholahs situated on the top or near the tops of the high hills, should be reserved in order to protect the springs that form the sources of our principal streams, within a certain distance of the town of Ootacamund, Coonoor, &c. It is also necessary to reserve forest for supplying the inhabitants with fuel; but I should say that it is quite beyond the province of the Commissioners to take into consideration the private requirement of an experimental Government garden.

Cinchona cultivation was originally introduced to induce private individuals and companies to undertake the production of bark in sufficient quantities to meet the great demand for quinine and to reduce the price of the febrifuge, and so place it within reach of a much larger proportion of the population. Now, however, either the original intention of the Government of India has been changed, or the local representatives have through carelessness or ignorance steadily placed obstacles in the way of the fulfilment of the intentions of the Supreme Government.

Sholah land, most suitable for the cultivation of cinchona, has been refused to applicants for the sole reason that the moss growing on the trees was required for use in the Government gardens.

The fact above proves that the Government Estates, as now worked, so far from being the means of encouraging extended cultivation, are the direct and only means of retarding it.

THE NEILGHERRIE CINCHONA PLANTATIONS.

Report for the year 1876-77.

THE administrative report shows that for the year 1876-77 the rainfall at Neddivattum was in excess of that of the previous year, but at Dodabetta the fall was very short. In both localities there was a long drought towards the end of the year, which is stated to have enhanced materially the cost of harvesting the bark, though to outward appearance the plantations have not been as yet seriously affected by it.

Expenditure.—The outlay amounted to Rs. 59,630 against an estimate of Rs. 57,325. The excess seems to have been caused by the omission to provide in the Budget for the freight of bark to be sent to England. The allotment for the up-keep of the plantations was not fully spent, owing apparently to an insufficiency of labor. This it is, in a subsequent part of the report, proposed to remedy by the provision of better house accommodation and the allotment of garden lands to coolies who agree to settle on the estates. The erection of suitable lines is approved, and funds have been set apart for this purpose in the Budget, but it will probably be necessary to somewhat raise the labor rates as contemplated by the Acting Commissioner. It is stated that the expenditure now given is for eleven months in the year, but the Government observe that the amount is the same as that returned in the Budget as the actuals of the year according to bills passed by the Accountant-General.

Receipts.—The revenue of the year was derived mainly from the sale of bark sent to England in the previous year, though the Government note that a small amount was realised from red bark supplied on demand to the Government of Bombay, and the hope that local demands for the dry bark will increase. The Acting Commissioner suggests that the value of the bark *harvested* in the year under report should be shown as the year's receipts, without reference to the date on which the proceeds were carried to account, but the Government have recently decided that it is more correct to enter only the amount received during the year. In paragraph 10, the Acting Commissioner calls attention to the existence of a brisk local demand for young plants, and reports that there are numerous applications from Ceylon for seed which is stated to there realize Rs. 40 per pound. Mr. Webster is of opinion that the orders at present regulating its gratuitous distribution, at the cost only of collection charges, might be reconsidered, and from the figures quoted it would seem possible that the seed so supplied may be parted with at a profit. The Government, however, view with much satisfaction this proof of the extension of cinchona cultivation; and so long as applications are impartially met and the cost of collection, &c., of seed is covered, while the process is not allowed to interfere with more important work, they are not disposed to make any further present change in the existing practice. The subject of the number of trees that have been mossed will engage the attention of Captain C. Walker, who is now engaged upon the duty, with which he has been entrusted, of enumerating the trees and thoroughly inspecting and reporting on the plantations. The Government will also await his report before considering the cost of harvesting the bark by the mossing process or other modes. The results obtained by the use of cattle manure appear to the Government very satisfactory, and, as it was demonstrated by the Quinologist that in the case of the *C. officinalis,* at all events, it produces a marked improvement in the quality of the bark, its use should be extended. The total bark harvest of the year was 104,346 lb. The prices obtained in England were quite abnormal, some bark returned in the broker's accounts as "*mossed crown,*" having sold at 15*s.* 8*d.* per pound. The next highest prices were for—

					s.	d.
Branch Crown	...	...	...	...	15	7
Unmossed ,,	...	...	...	...	13	9
Renewed ,,	...	...	...	...	13	5

For the red bark the best prices were—

					s.	d.
Unmossed	...	...	...	...	11	0
Branch	...	...	...	...	9	3
Renewed	...	...	...	...	9	2

The Government notice that the 1,000 experimental *Succirubra* trees were allowed to rest, and that it is stated that the bark of certain trees of the same species refused to rise. The Acting Commissioner will report whether these trees had already been barked, and generally as to the intervals at which it is found possible to remove with facility and advantage the renewed bark of the different species. Returns on these subjects were ordered some years ago and should now be regularly and carefully recorded. The Government desire not merely to maintain their own plantations, but to make the experience gained thereon available and useful to the public. It is reported that some of the shoots from trees of the Crown bark species coppiced at Dodabetta in 1875 are sufficiently advanced to bear barking next season. [illegible] issuing orders on this point, the Government wish to have full particulars as to the numbers and average height and girth of the shoots that it is thought could be barked.

The fifty-eight red bark trees at Neddivattum, the shoots from which are reported not to have done so well, were apparently coppiced in May 1873 (30th), and not in October as now stated, and it was considered that an unfavorable time of year had been elected for the felling. A small quantity of the bark of the C. *Angustifolia* is reported to have been taken for experimental analysis, and Government desires that samples of natural, mossed, and renewed bark of each species be now taken for a similar purpose. With this object special trees of known age and old enough to yield bark of good commercial value will be selected and reserved and be distinguished by numbers to facilitate future reference. The samples will be dried in the usual manner, and each will be marked with the number of the tree from which it was taken. The whole consignment will when complete be sent to the Government Office for despatch to the Secretary of State, and will be accompanied by a statement giving full details. In the case of renewed bark care will be taken to state whether it is of a first or later renewal.

CINCHONA IN CEYLON.

The *Ceylon Observer* has been favoured with the following report :—

CINCHONA.

PARTICULARS OF BARK SALES.

7th and 12th February 1878.

12 Serons Calisaya, flat, fair to good 3/6 to 4/6, bought in.
187 Serons do quill, middling to good 4/ to 5/3, bought in.
5 do do do bold 6/, bought in.
24 do do do inferior rusty 2/9, bought in.
892 Bales Soft Columbian, fair to good 2/4 to 3/3, about 80 sold at 2/8 to 2/10.
78 do do withdrawn.
321 Bales Carthagena, good to fine 1/9 to 2/6, all sold.
77 Bales New Granadiah, middling to good 2/2 to 4/6, bought in.
24 Cases Ceylon Cinchona, Red, good bright silvery quill 3/2 to 4/2, all sold.
23 do do do middling ditto 1,5 to 2/7, all sold.
21 Bags do do sifting and small 1/4, all sold.
29 do do do Crown, middling to fair small quill 2/6 to 3/5, all sold.
11 Bales Ashy Crown, good to fine 2/3 to 3/, all sold.
32 do do middling to fair 1/ to 1/9, all sold.
17 do Maracaibo, fair 6d, bought in.
5 do Cote, good 3/6, sold.
15 do Condurago, fair 3d, sold.

Your obedient servants,
JENKIN & PHILIPS,
51, Lime-street, 13th Feb. 1878.

Our contemporary remaks on this as follows :—

The remarkable feature of the sale of bark thus recorded is that Ceylon red bark, the produce of *C. succirubra*, sold at prices beyond those attained by American Calisaya or yellow bark. The only Calisaya bark which was allowed to be sold on this occasion ranged between 1s 9d and 2s 6d, prices which, heretofore, would have been thought very good indeed for red bark. But, while yellow bark, "good to fine," as above, fetched only 1s 9d to 2s 6d per lb., and while ashy crown bark (produce of *C. officinalis*), also "good to fine," from America, realized only 2s to 2s 3d, the Ceylon crown bark, "middling to fair small quill," sold for 2s 6d to 3s 5d. But the circumstance which renders the sale memorable is the position occupied in it by red bark from Ceylon. The very siftings of this bark sold for 1s 4d per lb., and we have an ascending scale until "good, bright silvery quill" culminated in 3s 2d to 4s 2d per lb. This would have been a good price for *renewed* red bark, but it is clear from the description that this was simply original bark. The "bright silvery" appearance of the outside was doubtless imparted to it by a coating of minute lichens, to the presence of which the brokers attach much—we believe undue—importance. The effect of the silvery outside of the bark contrasted with the deep red of the inner surface is very striking, and, besides the desire of druggists for specimens of this bark to display in their shops, it is quite possible, highly probable, that much of this high quality Ceylon red bark will be resold as Calisaya. Some of our readers may recollect statements to this effect made in a letter which Howard, the great quinologist, addressed to us with reference to a sale of what must have been similar bark, the produce of New Valley, in Dikoya. While siftings of this Ceylon red bark sold for 1s 4d, a price which will pay, it puzzles us to understand how stuff which sells in the London market at 3d a lb. can pay for the hides in which it is packed, and the freight, not to speak of the wages of the wretched cascarillos. The contrast in this sale is 15 bales Condurango bark, "fair," sold for 3d per lb., with 24 cases "Ceylon cinchona, red, good, bright, silvery quill," which all sold at 3s 2d to 4s 2d per lb. The trees from which this fine bark was taken were grown in the rich soil and fine climate of Haputale. The trees, too, were well matured, for they must be those we heard of as yielding such wonderful average results in weight of bark when cut down at 11 years old. Trees grown in Bussellawa and cut down at eight years of age gave just 1lb. of dried bark for each year of their existence. This result was enormously in advance of the results obtained from trees of similar age either on the Nilgiris or in British Sikkhim. Indeed, the late Mr. McIvor's great argument in favour of his stripping and mossing process was the miserable outturn of about 1lb. average per tree obtained when trees were cut down at eight years old, compared with the steady returns, year by year, obtained from trees subjected to his process. On the supposition that the Ceylon bark has been in every case as thoroughly dried as that in the case of the Indian experiments, it would seem that a Ceylon tree of *C. succirubra* eight years old gives seven or eight fold of the bark obtained from Indian grown trees of the same age, the coppicing system being understood in both cases. On the same understanding it would appear that, with each year additional of age, trees in Ceylon put on bark at a greatly increased rate of progression. The figures sent to us seemed to prove that, instead of 8lb. average obtained from trees cut down at eight years old, so much as 14 lb. became the average if the trees were spared until their eleventh year. That is, while 1lb. of bark for every year of the first eight is put on, the increase in the next three years is at the rate of 2 lb. per annum. Allowing interest and compound interest on capital locked up, it would surely be well to wait for such results, especially if, as the result of this sale seems to show, the quality of the bark so improves with the additional age as to secure about a doubled price in the market. The *Ceylon Times* has been furnished with information which shews that the red bark which thus rivals *Calisaya* in price was the produce of Sherwood Estate, Haputale. We quote from our contemporary as follows :—

There are one or two facts connected with the chemical analysis of and the broker's report on the 29 cases of Happotelle (Sherwood) bark which deserves notice. The analysis made by M. Paul gave the following results :—One pound weight 7,000 grains of the bark contained—

133 grains, or 1·9 per cent crystallized sulphate quinine.
209½ grains, or 2 99 ,, cinchonidine.
184 grains, or 2·62 cinchonine (alkaloid.)

An analysis of 20 bags pieces of bark shewed that the same quantity, viz., 7,000 grains contained—

65¾ grains, or 0·94 per cent. crystallised sulphate quinine.
110½ grains, or 0·58 ,, cinchonidine.
63 grains, or 0 90 ,, cinchonine (alkaloid.)

A return of the relative yields of barks grown in the plantations of India, prepared by the Government quinologist, Mr. Broughton, had the following results :—

	Pure Sulphate of quinine.	Total yield in alkaloids.
Mossed crown bark at Doddabetta ...	3·84	6·60
,, red bark at Nedduvattum ...	0·74	6·20
Renewed red bark at do ...	2 92	5·82
Red bark at Pykara ...	0·62 ...	7·11
Red bark at do ...	4·75	4·45
Crown bark do ...	3·11	5·23
Crown bark at Doddabetta ...	2·04	3·61
Branch red bark do ...	0·81	3 58
Crown bar at Pykara ...	2·39	3·42

An abstract of the above, compared with the Sherwood analysis in regard to the alkaloid-yielding properties of the various descriptions, will stand in the following order :—

1.—Mossed crown bark at Nedduvuttum.
2.—Ordinary do. at do.
3.—Renewed red bark at do.
4.—Sherwood bark.
5.—Crown bark at Pykara.
6.—Crown bark at Doddabetta.

If, however, the above parcels of different barks were to be classed according to the yield of alkaloids per tree, the Sherwood cinchona would stand first in the list by a great deal ; as each tree yielded 14¼lbs. of the dried bark, the others only 7lbs. and 8lbs.

The analyses were an indication of the relative, though, it seems not of the actual, value of the whole ; for whilst the result of the examination of the contents of the bags gave a value of about 1s 3d per lb, they realised at the sale 7s 4d, being termed in the broker's report "good twigs and mixed chips." The contents of 22 of the cases were reported "bold, thick. showy, picked quill, nicely selected, value from analysis to manufacturers, 2s 3d to 2s 6d ; but will probably bring about 3s 6d for druggists' use." The distinction here drawn, we confess, we do not understand. The result, however, went to shew that owing to a keen competition for these unusually fine, well-prepared lots, they realized from 3s 8d to 4s 2d, whilst the contents of other cases were spoken of as "short and broken quill, bold, thick and showy ; manufacturing value about 2s 3d to 2s 4d :" these realised at sale 2s 3d to 2s 4d.

On the whole, the result of this sale must be regarded as extremely satisfactory to the proprietor of Sherwood, as it shews that as no special cultivation was adopted, the soil, climate, and altitude must be eminently adapted to the growth of fine bark and the production of the more valuable alkaloids. It follows, therefore, that given the soil, climate, and altitude, a careful attention which in this instance appears to have been given, to the preparation and packing of the bark, is certain to ensure good and profitable results.

Figured statements lose all their value if they are incorrectly printed; and any one with the slightest knowledge of the constituents of the febrifuge barks will say at once that red bark never gave, and never will give anywhere in the world, what is attributed to "Red Bark at Neddiwuttum," *viz* :—Pure sulphate of quinine 4·75. per cent. ; total alkaloids 4·75. Such a result would mean not only that red bark gave 4·75 of pure sulphate quinine, but that the whole of its alkaloids consisted of pure quinine ! Such a bark, if it could be produced, would revolutionize the whole history and chemistry of the cinchona trade. As much as 13 per cent. of sulphate of quinine *has*, in rare instances, been obtained from *C. Calisaya* (variety *Ledgeriana*) and from *C. officinalis* (variety *angustifolia*), but this the chemist had to separate from certain proportions of cinchonidine, cinchonine, and other inferior alkaloids. We have little doubt that the correct figures for the Neddiwuttum bark should be 0·74 per cent of pure quinine out of a total percentage of alkaloids equal to 4·45. For we have before us as we write the results of apparently the same analyses (two) by poor Broughton, of Neddiwuttum red bark, the figures for which are thus given :—

Total alkaloids, 4·45.

of which there were—

Quinine and quinicine	1·31
Cinchonidine and cinchonine	3·14

and from these alkaloids were obtained pure sulphates crystallised—

Of quinine	0·74
Of cinchonidine	1·62

From mossed red bark grown at Neddiwuttum, it will be observed Mr. Broughton obtained no less than 6·20 per cent. of total alkaloids, but still the proportion of pure quinine was under three-fourths of a percentage, and this result was used as an argument against the value of the mossing process. Most unjustly, because not only is cinchonidine the alkaloid for which red bark is distinguished, but little inferior to quinine itself in therapeutic value; but the mossing process, especially in the case of renewed bark, reduces to a minimum the colouring matter and tannin, the existence of which constitutes the explanation of the very correct statement which the *Times* editor professes not to understand. The first-class Sherwood red bark, with its

1·09 per cent. crystallized sulphate of quinine.
2·99 do. cinchonidine.
0·80 do. cinchonine (alkaloid) [that is, not crystallized in this case],

was estimated to be worth to chemists like Howard, who work chiefly with reference to pure quinine, and secondarily with reference to cinchonidine, 2s 8d to 3s 11d per lb ; but for *druggists'* use would probably bring about 8s 0d. Others besides our contemporary may require to be told that the colouring matter and tannin, in the red bark, which are so objectionable to the chemist in the delicate processes resorted to in order to obtain pure sulphates offer no obstacle to the druggist in the preparation of tonic and other *decoctions.* For preparations of this kind good red bark is almost as useful as fine yellow or crown bark. The value of the latter to the manufacturer of portable and elegant sulphates, a pinch of which is equal in effect to a cupful of bark decoction, lies in the abundance of the finer alkaloids in the bark cells, and the absence or slight admixture of refractory substances, such as colouring matter and tannin. The grand advantage of the mossing system, which, or its equivalent, we yet hope to see prevalent in Ceylon, is that it improves the "druggists' bark" of the robust and easily grown *C. succirubra* to something like an equality with such "manufacturers' bark" as the products of *C. Calisaya, C. officinalis, C. Pitayensis,* &c, If natural red bark from the Sherwood trees gave 1·09 per cent. of pure quinine, and 3 per cent. of pure cinchonidine, mixed with colouring matter and tannin, we are confident that the same bark, after being a year under moss would have yielded 1½ per cent. of quinine and 4½ cinchonidine, colouring matter and tannin being reduced in proportion. Renewed bark from the same trees would, to be sure, lose the silvery appearance of which the brokers make so much, and for the absence of which they at first condemned mossed bark. Renewed bark is a mass of cellular tissue full of valuable alkaloids (quinine and cinchonidine) and with scarcely any colouring matter or tannin. The price certainly rises in the proportion of—

Original bark	1
Mossed original	2
Renewed under-moss	3

Had the proprietor of Sherwood seen and learnt what we saw and learnt on the Nilgiris, his last idea would have been to have cut down trees which would have yielded him a steady and large annual income instead of a sweep at once, and then a long wait for more, if, indeed, the trees have been coppiced. We go on the assumption that cinchonas in Uva are not so injuriously affected by wet and wind as unhappily they have been in the younger disricts during this exceptionally disastrous monsoon. In Dimbula and other neighbouring districts we seem to have no choice but to cut down a large proportion of our trees, especially *C. officinalis*, which is intolerant of strong wind, damp, or a retentive subsoil. Notwithstanding the occurrence of an exceptional season, we must thoroughly believe on the climate of the younger districts as suited for cinchonas, and the soil can be improved by deep-draining and the addition of lime to the rather irony earth—earth in which tea luxuriates. We know that wind and rain this last exceptional season have been as fatal to cinchonas on the Nuwara Eliya side of the ridge as in Dimbula and the adjacent districts. What about Haputale, Maturata, Ramboda, and the scene of the largest experiment, Hewaheta ? Before writing more fully on the stripping and mossing system, we should be very glad to have the opinions of observant and honest correspondents as to the probable *life* of the two leading species of cinchonas, in different districts, if the period differs. *C officinalis,* which flowers and seeds sooner than its friends could wish, seems to mature at about five years old. How long, with fair play, is it likely to live after this maturity for bark purposes? Here, as in India, eight years has been taken as the period of maturity (comparative) of *C. succirubra* On the Nilgiris we saw trees of this and also of *C. officinalis* still robust, though much infested with lichens, seventeen years old. What are the likely chances for duration of this tree in Ceylon ? And what has any correspondent to recommend in addition to deep-draining and liberal liming to counteract the effect on cinchona trees of damp in heads of ravines and retentive or ferruginous subsoil ? If we are favoured with answers to these questions, we think we can, in return, tell cinchona-growers something to their advantage. One fact we may mention to show how largely cinchona cultivation engages attention. From one estate in Dimbula cinchona seed to the value of upwards of 2,000 rupees was sold in a few months of this season. If, therefore, wind, damp, and retentive subsoil do not intervene, we leave our readers to judge from a fact like this of the eminence to which cinchona cultivation in Ceylon will reach a few years hence.

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THIS Manure is especially manufactured for the growth of the Tea Plant in India. The object is to supply back again in the same rates to the soil those elements which the plant extracts from it, and, at the same time, having due regard to the proper balancing of the constituents, so that the stimulating properties shall not be in excess of its fertilizing quantities as is the case with Peruvian Guano, Nitrate Soda, Sulphate of Ammonia, and many patent and artificial manures that are sold without the slightest regard to the duties they have to perform. Most of the above manures, although found to stimulate the plant producing luxuriant growth do not supply some of the most important elements of nutrition, but more vegetable growth, at the same time exhausting the soil by returning to it only its Nitrogen, leaving the Phosphates, Potash, and other elements to be extracted annually by the plant and in course of time the land becomes barren and sterile. The result is now developing itself in many places, more especially on the sugarcane lands.

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NOTICE.

AGRICULTURAL PHOSPHATES COMPANY, "LIMITED."

I HAVE now to submit to you my report on the several samples of Bones and Bone Crushings you sent me for analysis. The result you will find arranged in a tabular form, upon which I have a few remarks to make.

I have stated the several constituents in such a way as will be most useful for economic purposes. The phosphoric acid present, for instance, may partly exist in the bones possibly (in very small proportion) as phosphate of magnesia or of soda, but that is more a matter of scientific interest than of practical value, so I have calculated it all as phosphate of lime, as is usually done.

The composition, on the whole, is tolerably uniform in all the samples, as will be seen by a reference to the quantity of phosphate of lime and of ammonia—the two leading and important constituents—in the various samples, and this will bee seen better by comparing the proportion of these with that of the sum of the essential constituents, that is, excluding water and sand, which may be considered as accidental constituents, more liable to variation than the others from accidental circumstances.

The principal difference is produced by the steaming which removes the fatty or oily matters and some small portion of other constituents. It also diminishes to a small extent the proportion of phosphate of lime to that of the whole earthy salts, and so appears to increase the proportion of carbonate of lime, &c. The phosphates deficient probably exist in the bones in the state of soluble compounds, which are removed by the steaming, but from the smallness of the quantity this is of no great practical importance.

The steaming diminishes to some extent the proportion of animal matter, and consequently of ammonia. The bony matters become more brittle and does not retain water to such a degree as the unsteamed. The removal of the tough and glutinous animal matter will render the material more easily acted upon by the atmospheric water and carbonic acid, and so more readily assimilable by vegetation. It will also render it less liable to decomposition by keeping, and consequently prevent the result of that, namely, the escape of ammonia. This, I think, there can be no doubt of.

There are a few small discrepancies exhibited by the table which cannot be accurately accounted for. The large amount of sand in the bone dust may be due to the circumstance that the sand will naturally accumulate in the finer stuff: that of the raw bones from the amount of dirt adhering to them. As for the others, it is almost impossible, in an article like this, to be certain that the samples of the different varieties all proceed from exactly the same kind and mixture of bones.

CONSTITUENTS.	Entire Bones.		Bone Crushings.		Bone dust
	Raw.	Streamed	Raw.	Streamed.	Stream
Phosphate of Lime	51·12	57·86	55·31	55·89	56·11
Carbonate of Lime with a little Magnesia, Iron and Alkalies, &c.	8·98	10·15	9·88	11·43	12·11
Animal Matter, dry ...	25·35	25·91	24·72	24·16	20·88
Essential constituents	88·46	93·45	89·90	91·78	88·60
Siliceous earth and sand ...	2·92	1·47	·44	1·24	4·82
Water	8·62	5·08	9·66	6·98	6·58
	100	100	100	100	100
Ammonia yielded by complete decomposition	4·67	4·95	4·68	4·34	5·22

The Table speaks for itself. The numbers given are for the products in their ordinary condition, and sent to me. In some points of view it might be better to state the proportions of the constituents for the dry substances, that is, deducting water, or deducting both water and sand. This is a mere question of calculation by simple proportion.

DAVID WALDIE.

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The basis of this manure are the ashes of cow-dung, horse-dung, stable litter, etc., supplemented by Bone Dust and Potash Salts.

The manure, as now prepared, is guaranteed to contain—

5 to 6	per cent. of	Potash, equal to 10 per cent. of Sulphate of Potash.
6 to 7	,,	Soda and Chloride of Sodium.
20	,,	Lime and Magnesia.
7 to 8	,,	Phosphoric Acid, equal to 16 per cent. of Phosphate of Lime

the remainder being Sulphuric Acid, Iron, Carbonic Acid, organic matter and Silica. The same manure can also be supplied, containing, in addition, from 2 to 2½ per cent. of Nitrogen, in its most available form.

The manufacturers desire to point out that the manure they offer, contains *all* the constituents of plant food, in a state available to the plant, and the cost of it will compare favourably with that of other manures of equal value.

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Extract from Official Report of tests made at H. M. Calcutta by THEODORE W. H. HUGHES, ESQ., F.G.S., A.R.S.M., Officiating Deputy Superintendent, Geological Survey, India.

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of a country, remarked, "About 87 miles north of Bangalore is the range of hills of which Nandidurg forms the most conspicuous object, some friends encamped at the foot of these hills were at a loss to account for the circumstance that Nandidurg was often clear of vapour when two other hills close to it were covered with a cloud; nor were they able to account for it, till on ascending these hills, they were found to be covered with a stunted vegetation from which Nandidurg was free. When encamped on Nandidurg I observed rain frequently fall on those opposite hills, apparently avoiding the one on which I was. Doctor Darwin supposes that as the summits of mountains are much colder than the plains in their vicinity, they condense the vapours more readily and so contribute to form springs. Supposing Doctor Darwin's theory to be true, which I have no doubt it is, the condensation produced by the cold top of Nandidurg actually higher than the neighbouring hills, was more than counterbalanced by the circumstance of the other being clothed with verdure."

The rain attractive influence of forests did not escape the attention of that good old navigator, Christopher Columbus, who ascribed the frequent showers which refreshed and cooled the air, as he sailed along the coast of Jamaica, to the vast extent and density of the woods that covered the mountains of that island; he mentions in his journal that formerly rain had been equally abundant in Madeira, the Canaries and the Azores, *before their shady forests were felled or burnt by the improvident settlers.*

This, you will very correctly say, is an instance of the acceptation as truism of what is only mere supposition or popular belief. Granted. But Christopher Columbus based his assumption upon the result of an attentive and wide-spread observation of nature; and the recent experiments conducted by the French savants, and the writings of M. J. Clave, Belancer, Fournier, Merchand and other scientific men of the age prove conclusively that "The Great Discoverer" struck the right nail on the head when he attributed to the presence of trees and forests the copious showers of rain that greeted his ships off the cost of Hispaniola.

Sir John Herschel during his residence at the Cape of Good Hope observed a remarkable illustration of the influence of trees in condensing the vapour of the atmosphere on the side of Table Mountain, from which the wind blew, the cloud spread out and descended very low, frequently without any rain falling; while on the other side they covered the mountains in dense masses of vapour. When walking beneath tall fir trees at the time these clouds were closely overhead, he was subjected to a heavy shower of rain; but on going out from beneath the trees the rain ceased. The explanation he gave of the phenomena was that the clouds were condensed into rain on the cool tops of the trees, and doubtless the innumerable fine leaves of the fir trees adding largely to the surfaces of evaporation increased the cold, and *thus* condensed the vapours into a more copious shower.

I think that the above is quite enough for the present to prove the utter fallacy of your remark that "forests do not directly influence rainfall," and although I am prepared to continue the subject, my letter is assuming so great a length that I shall postpone further remarks on this head to any future opportunity I may be given.

You acknowledge the importance of forests in other ways, more particularly in regulating the distribution of moisture and in preventing erosion. I do not see how you could help doing otherwise. The outlook from a railway carriage travelling to Poona from Bombay or *vice versa* would afford "experience" and enable you to find evidence in support of these truisms.

Turning to the question of planting trees upon the boundaries of fields you cite the advice of Mr. Mechi, "one of the greaest living agricultural reformers." But you quite lose sight of the fact that Mr. Mechi's advice was given to the landowners in sea-girt islands, and *not* to the cultivators of a tropical continent. Local circumstances and conditions must determine the applicability of general rules and axioms, and consequently the advice of "the greatest living agriculturist" upon the treatment of cultivable lands, though it may be must beneficially followed in connection with the country, regarding which it was enunciated, would possibly be conducive of disastrous consequences if brought into strict operation in a country, the conditions and circumstances of which are totally different.

The British Islands are situated in a higher latitude than the Bombay Presidency, and the sun has less power of evaporation over the soil. Then, again the rainfall, instead of being restricted to a monsoon season; and the unclouded sun left full play during the rest of the year, is distributed more generally over the twelve months. "Autumnal rains," we know, predominate in England, and spring showers and "summer rains" are of frequent occurrence; the British Islands, too, being bounded by the warm waters of the Atlantic on the one side, and separated from the Continent on the other only by narrow belts of sea, are subject to [illegible] mists. The reason of this is that the land being [illegible] than the sea in summer and colder in winter, mists [illegible] of [illegible]. [illegible] much more [illegible] United Kingdom [illegible] the former being warmer [illegible] the dryness of our atmosphere during the greater part of the year, which is attributable to the prevailing direction of the wind, it being *from the land to the sea*, is evidenced by the clearness of the sky. Clouds are nothing more than mists which hover in the higher regions of the air, as mists are nothing more than clouds resting upon the surface of the ground; and clouds, fogs, and mists are simply air saturated with moisture. Thus it can be conceived how the constant presence of moisture in suspense over, and bedewing, the land can counteract the deteriorating effects of the rays of the sun acting directly upon the soil.

In India conditions are very different; comparatively speaking, there is a marked absence of clouds, fogs, mists and moisture in the air, during the greater part of the year, and therefore it is imperative that the deterioration or exhaustion of soil resulting from too rapid evaporation should be prevented by other agencies; and this is in a measure possible by planting trees upon the boundaries of fields, the foliage of the trees, except when the sun is vertical, interposing a leafy screen between the soil and the direct solar rays.

It is not, I presume, for one moment contended by "B." or any one else that fields should be covered all over with mango or other trees and crops should be grown under their dense canopy, but that trees should be cultivated on the sides of fields so that during a greater part of the day a certain quantity of shade may be thrown by the trees over the surface of the field, more especially when the crops are suffering from absence of moisture, and when the crops are off the ground.

It is very satisfactory to learn that despite Mr. Mechi's advice about cutting down hedgerow timber, the feeling is gaining ground amongst farmers in the United Kingdom that the planting and preserving of trees in hedgerows is beneficial to cultivation, and this feeling will become more general as education advances and the subject is better understood.

Trees are the best fertilizers of the soil; the land upon which trees grow improves by their cultivation. Pasturage lands improve by having trees planted not too densely upon them, as abundant experience in the Deccan as well as elsewhere has shown, and experience in our Presidency has testified and is daily testifying to the fact, that when trees upon cultivable lands are cut down instead of the land having been exhausted and rendered unfit for pasturing or agricultural purposes by the trees, it has been regenerated so that bumper crops are taken from its soil.

There are surface-rooting as well as deep-rooting trees, but it may be accepted as a very safe law that trees return to the soil *ten-fold* what they take from it. Trees are the grandest and noblest products of the soil; the powerful influence which a productive soil engendered by the intervention of forests exerts on the condition of countries is proved by historical facts. Let then every district officer preach to the cultivators of this Presidency the wise words of advice given by Sir Richard Temple to the people of Dharwar, *Restore to the soil the trees you have robbed from them.*

Poona Districts, November 14. **FORESTER.**

The Indian Agriculturist.

CALCUTTA, JANUARY 1st, 1878.

DEEP CULTIVATION.

If we enquire into the fundamental principles on which the great success of modern agriculture is based, we find them three in number:—Deep cultivation—Judicious and ample manuring and—Selection of seed. We are certainly within the mark when we say, that the general adoption of these principles in England, under the fostering care of great and wise landlords, has nearly trebled its agricultural production. To Germany, to the great Liebig, we owe the revolution in agriculture which the last three decades have witnessed, but it is to the enterprise and energy of Anglo-Saxons, it is to the wealth and forethought of England's great Landlords, that we owe the successful introduction into practical agriculture of those scientific principles, which at one time the whole of Europe considered to be senseless effusions of a diseased brain. When Liebig's great genius comprehended the true principles on which vegetable growth depended, principles which were destined to open a new era for agriculture, when he proclaimed them to the world and deduced their bearings upon agriculture, the practical agriculturist [illegible] in opposition, and apparently proved by facts that Liebig's theories were wrong. Many of our readers will remember the violent discussion which took place at the time between science and practice. But Liebig's genius rose equal to the occasion: rashly he had uttered his theories; patiently and slowly he set to work to prove them, and when twelve years after, he finished his task, and published the results in his "Natural Laws of Husbandry," who is there that does not acknowledge that he fully succeeded in the Herculean task he set himself. For his experiments proved every one of the scientific principles he had laid down, with the exception of his supposition that, as plants absorb their mineral food in a state of solution in water, this food must exist in a soluble form in the soil. He found out afterwards that such was not the case, and that the mineral plant food in arable soil, enters into peculiar combinations, which though insoluble in water, become immediately soluble in that medium, when *Osmose* and *Exosmose* and the vital force of plant life are brought to bear upon them. He crowned his work by discovering what is now called *the physical combination of available mineral plant-food in arable soils.* He explained that the cultivating processes of husbandry, meant but the development of available mineral plant-food from their unavailable chemical combinations, by the action of atmospheric influences; to be arrested, as soon as rendered soluble in water, by the physical attraction of the surrounding particles of arable soil. He explained what is the difference between the arable surface soil of our fields, and their unarable subsoil, and his principles showed us how to more than double the yield of a field by increasing the depth of its arable surface soil, and how to increase the quantity and improve the quality of agricultural produce, by *deep cultivation.*

Many of our readers will remember that, not so very many years ago, the columns of agricultural papers in Europe, teemed with records of experiments regarding deep cultivation, the favourable results of which convinced even the most conservative farmer. Deep cultivation, we may say therefore, is now an acknowledged fundamental principle of agriculture, and it has more than doubled the agricultural capabilities of some districts in England.

But here it will be opportune to draw attention to the difference between deep *cultivation*, and deep *ploughing*, which is an essential one. Deep ploughing brings the under, or subsoil of fields to the surface, not always, be it remembered, an advisable procedure; while deep cultivation, or sub-soiling, leaves the subsoil in its oirginal position and only stirs and loosens it, rendering it permeable to atmospheric influences, and thus increases the depth of the surface soil without producing any evil consequences.

As a general rule, deeper ploughing should be done gradually, that is, the process of deepening should be the work of some time. There are soils that may be deepened at once and in one operation, without any bad results: but such soils are scarce. On fully 90 per cent. of our cultivated land, it would be unwise to increase the depth of the soil suddenly by deeper ploughing, as the raw subsoil thus brought to the surface would lessen the productiveness of the surface soil, until by exposure to the chemical action of atmospheric influences, it loses its pernicious properties, and becomes fitted for the support of plant life. There are very few instances in which it is safe to bring up by deeper ploughing more than 2 inches of the subsoil during a year; indeed, if the soil was an ordinary one, and it became necessary that it should be ploughed 6 inches deeper than it had formerly been ploughed, we should prefer to arrive at the desired depth in 4 years, instead of 3; though had we a plentiful supply of lime, and of other manures, we should be satisfied with a much less time to effect this. If deeper tillage is, therefore, to be attempted by means of the plough, it will be wise to proceed gradually; but if by the means of the sub-soiler or cultivator, the desired depth may be obtained at once, as no harm can result therefrom. It is necessary that these distinctions should be remembered.

No soil can suffer from deep tillage, if the sub-soiler or the cultivator only, is used; but deeper tillage by the plough may, for a time, produce injurious results, partly from physical, and partly from chemical influences. The new soil brought to the surface may be soapy and retentive, and thus may render the land difficult to bring into a condition fit for the reception of seed; or the raw soil may contain salts in chemical combinations, which are injurious to plant life, and which under exposure to atmospheric agencies, must assume new combinations before healthy crops can be produced. These injurious agencies may be neutralized by exposure to atmospheric influences, but a long time is needed to effect this; however, by the liberal use of lime and of other manures, much can be done to facilitate the changes, needed to restore the soil to a healthy state.

Bearing in mind now, what deep cultivation has done for England and other countries, we have long regarded the shallow cultivation of Indian agriculture, as one of its greatest faults. Before the introduction of deep cultivation into England, the usual depth to which the soil was cultivated and was arable was five inches, it is now more than double that. The average depth to which soil is cultivated in India is three and a half inches; and when we come to enquire why this shallow cultivation, we are told that such has been the habit of the cultivator from time immemorial. Nothing could be said against the system, if plants confined their area of mineral food absorption, to the depth of three and a half inches, if their roots would descend only that depth and not further. But when we find that plants wherever possible, send their roots down into the subsoil, and when this is stirred or deeply cultivated, that they double and treble their root surface, and that the yield stands in direct proportion to the greater or less root surface, then indeed we cannot estimate too highly the introduction of deep cultivation into India, nor advocate it too strongly. Liebig attaches the utmost importance to deep and efficient tillage, as an agricultural basis. He says: "The agriculturist has to do with the soil alone; it is only through it that he is able to exercise an immediate influence on plants. The attainment of all his objects in the most complete and profitable manner, presupposes the exact knowledge of the effective chemical conditions for the life of plants in the soil; it further presupposes perfect acquaintance with the food of plants and the source from ~~which it is derived~~, as well as with the means for ~~rendering~~ the soil suitable for their nutrition, combined with experience and skill in employing them in a proper way, and at the right time." Science has indicated, that in the subsoil we should seek for increased profits, for it teaches us that in the great majority of soils, the earth at every depth contains a certain portion of the elements of plantfood, which only requires aëration and amelioration by disturbance, drainage, and manure, or by burning, to render them gradually available as plant food.

But there is another phase which enters largely into the question, when considering the advantages of deep cultivation in India. It is the security against drought, which crops on deeply cultivated soil enjoy, that makes the general introduction of this system into India so important a measure, worthy alike the most earnest consideration of the rulers and the ruled. The results of deep cultivation in India have repeatedly been brought to the notice of Government. When under the pressure of the Home Government, the latest spasmodic effort to improve the cultivation of cotton in India was engaging the attention of officials and the public, Mr. Rivett Carnac, the director-in-chief of the cotton experiments, said in his report on the cotton season 1869-70: "Various experiments have been tried with deep ploughing, &c. Notwithstanding an unusually bad season, the result has been satisfactory, the staple has been pronounced to be excellent, and the out-turn of cleaned cotton to the acre from the selected seed has been large, and in one case the combined effect of good seed and deep ploughing resulted in an out-turn of 255lbs. of cleaned cotton to the acre. The case was, it is true, an exceptional one, as the soil of the field in which the crop was sown was superior to the ordinary run of the cotton-growing tracts. But from ordinary fields in the farm during this, an unfavorable season, as much as 180lbs. of cleaned cotton was picked from the acre. The results are therefore encouraging."

" So far therefore as can at present be judged, it would appear that deep ploughing is of great benefit to the plant, and those parts of the seed farms which have been thus treated show very favourably by the side of the fields cultivated according to the ordinary native method. The plants on the well-ploughed fields were much stronger and healthier than their neighbours, and, as already noticed, 180lbs. of clean cotton per acre was picked from these fields. This season an ordinary native field hardly yielded 50lbs. to the acre. The experiments of this season have indeed been so encouraging that it is proposed to order from England a steam plough for use in the Central Indian country."

Need we say, that this spasmodic effort long since died a natural death, and that nothing further is heard about the improvement of cotton cultivation in India. Then again Mr. Robertson, the Superintendent of Madras Government farms, said in one of his annual reports, we believe of 1875-76 :—

> " Some most mischievous opinions have recently been spread through India, regarding the effects of deep cultivation in hot climates; I feel it my duty, therefore, to state most unreservedly that the result of my six years experience in actual cultivation in one of the hottest parts of Southern India has convinced me beyond all doubt that the advantage which the Madras farmer will secure by deeply tilling his soil, can scarcely be overrated. A dry season brings out in a decisive way the results of deep culture; during the long drought experienced last year, the maize plants growing on a piece of land on the Experimental Farm that has been sub-soil drained in the previous year, were more than twice as large and proportionately more luxuriant than plants on adjoining lands, and those plants again that grew over the newly filled drains were still larger than the plants that grew on the land between the lines of drains the former during the greatest heat were always remarkably luxuriant, they drew their supplies of moisture far down below the parched surface soil, while the plants on the intervening spaces were puny and sickly, their roots not being able to penetrate more than a few inches below the parched upper soil. Similar results I have always obtained whenever I have had the soil deeply cultivated. I have gradually year after year deepened the cultivation on the Sydapet Farms until the soil is fully 50 per cent., deeper than similar soils under ordinary native farming, and I would gladly go deeper still; indeed I feel sure that we can never secure good average results from our farming, until we do cultivate deeper. In the hottest season the crops on the deeply tilled soil are generally fresh and luxuriant in appearance, while those growing on shallow soils are parched and withered".

And latterly, the Mysore Commissioner has published, in the Mysore *Gazette* of November 17th 1877, the results of some experiments carried out by Mr. Harman on the Bangalore Experimental Farm, with a view of testing, by comparison, the relative value of deep and shallow cultivation on good land for the growth of *raggi*, the favorite and most largely cultivated grain of the district. Our readers will remember that the season was an unusual dry one, and that the *raggi* failed throughout that part of the country. Exceptional opportunities were therefore present to show the advantages of deep cultivation *versus* shallow cultivation, and we are not at all surprised at the result.

The plots on which these experiments were carried out numbered three, worked respectively from October 1875, May 1876, and March 1877, with English ploughs, to a depth of 8, 7 and 5 inches respectively; and a plot cultivated by the Native plough, from time immemorial, to a depth of 3½ inches. In the two plots which had been longest under the new cultivation, we also note that the report draws attention to the accumulation of decayed organic matter ensured by the English method of killing and ploughing in the weeds. All the plots were lightly and similarly manured. The plots were sown at the end of last May, and harvested in the beginning of last October. The results are given in the Report as "financial," the price of seed being that at which it was severally bought and sold. The returns from the four plots are 1,340, 730, and 300 measures *(Seers)* from the English ploughed land, and, notwithstanding three consecutive sowings, nothing from that under native cultivation, which result is that attained over most of the province, as the whole of the first two sowings were failures, and much of the third only partially succeeded. Deducting the expenses of cultivation, and allowing for the value of the straw, the profit is shown to be Rs. 133-8-1, Rs. 63-6-0, Rs. 15-5-10, with three successful crops under deep cultivation, while the cultivation under the native system, as the crop was a total failure, entailed a loss of Rs. 12-2-0. The large profits are due to the *raggi* being sold at famine rates at ten seers per rupee during the month of October.

The figures stating the profit are, of course, of no value and would be misleading if considered applicable to ordinary seasons, for then *raggi* sells at 30 to 40 seers per rupee, the fact alone that deep cultivation enables us to grow dry crops in a season of prolonged drought, concerns us here.

The depth of loose soil in these different plots, bears a curious proportion to the out-turn :—

Plot No. 1	Depth of loose soil	8	inches	Out-turn	1,340	measures.
Do. „ 2	ditto	7	„	„	730	„
Do. „ 3	ditto	5	„	„	300	„
Do. „ 4	ditto	3½	„	„	*Nil.*	„

" These results," says Mr. Harman, " are of much interest as shewing that, had deep cultivation for *raggi* been the rule instead of the exception, the staple grain of the country might have been available in quantity at this early date to arrest import and save money from flowing out of the country; while the advantage of growing 2,813lbs. per acre, at a time when the whole country is suffering from drought and famine, by the simple adoption of deep cultivation is too obvious to need comment, more especially when, even in favorable seasons, the average return by shallow cultivation is only 512lbs. per acre throughout the province. The saving of labour by using English ploughs, which plough so much more land in a given time, is allowed for in the calculation; and through the heavy loss of plough-cattle throughout the Province during the recent unfavorable years, it is a point demanding attention, if the land under cultivation is to retain its present area" Mr. Harman concludes his paper which we publish in *extenso* elsewhere, by stating that " the cultivation of other crops by means of deep cultivation is equally striking. Cumboo, cotton, potatoes, gram, cholum and maize have been seen by numerous visitors to the farm in various stages of growth, and the unanimous verdict is that they are severally the finest that have ever been seen by the examiners."

In addition to this *raggi* crop, we are informed, there is a rice crop standing on one of the plots of the Bangalore Experimental Farm, which promises to yield at the rate of nearly 3,000lbs. per acre. The crop has been grown dry, without any irrigation, during a season of prolonged drought, the secret of success being deep cultivation. The roots of the rice-plants went far below the surface into the subsoil, and were thus enabled to draw their sustenance from below the dry, parched up, surface soil. We shall look forward with interest to the official report on this rice experiment, though we doubt whether the yield will be quite as high as the estimate which we consider very sanguinary, considering that the ordinary yield per acre of a dry rice crop is, from 500 to 800lbs., and of an irrigated one, from 1,000 to 1,200lbs. per acre, that is under shallow cultivation. But rice has always been considered a crop requiring such an excess of moisture, that to get a crop at all under the circumstances ought to convince the most sceptical of the advantages of deep *versus* shallow cultivation. If it is therefore the earnest wish of our Government, the landlord of this vast Empire, to improve Indian agriculture, let us make a beginning by introducing deeper cultivation throughout the length and breadth of India.

Let a handsome prize be offered, large enough to attract English and American manufacturers, for the best plough and the best sub-soiler, adapted to the cattle and the habits of the cultivators of this country. And then let Government distribute a few thousands of these ploughs to the most advanced and enlightened zemindars and other agriculturists, offer prizes for the best cultivated fields, and establish centres where these ploughs could be manufactured and supplied on demand. We even go so far as to say that these ploughs and sub-soilers, if their primary introduction is successful, should be supplied *gratis* to the ryots, not in thousands but in hundreds of thousands, for we consider that improved ploughs and deeper cultivation is the means by which we may succeed in supplanting a vicious system of spoliation of the soil by a rational system of true husbandry.

MR. BUCK ON INDIAN AGRICULTURE.

We publish elsewhere a paper on Colonel Corbett's pamphlet on the "Climate and Resources of Upper India" by Mr. E. C. Buck, Director of Agriculture, N.-W. P, and Oudh, which our readers must not overlook. Colonel Corbett had, for years, devoted a great deal of his spare time to agricultural experiments and observations, having in view the improvement of native methods of agriculture in Upper India, and he has published his matured views in the above pamphlet. It is owing, chiefly to his sudden decease shortly after, that the pamphlet had not received that public attention which it deserves, and we were therefore glad to see the prominent attention of Government drawn to it by Mr. Buck's paper. The chief features of Colonel Corbett's pamphlet, are his advocacy of an extensive system of arboriculture, of the necessity of increasing the vegetable matter in the soil, and thirdly and perhaps most important, of substituting deep cultivation of the soil for artificial irrigation, of which the canal is the chief exemplar. And with the same warmth with which he advocates these methods, he denounces surface drainage and irrigation, and supports his views with facts and observations of earnest and impressive truth. Mr. Buck has done justice to the pamphlet, and has not only fully reviewed it, but has given us an exposition of his own views on the chief important subjects referred to by Colonel Corbett, which carry great weight with them when we remember that Mr. Buck, as Settlement Officer, has for years been in constant intercourse with native cultivators, and his utterances must therefore not be considered mere theoretical principles, but the practical conclusions of a careful observer. There is one point, however, Mr. Buck has, in our opinion, not laid sufficient stress on. Colonel Corbet says: "Lands under constant irrigation which formerly produced wheat, are now said to grow only rice, and previous rice-plantations to produce no other crops than reeds and rushes." Mr. Buck supports this statement, and we have thus another lamentable proof of the exhausted nature of India's soil, to which we have so repeatedly drawn attention. Before irrigation was introduced, the ryot obtained annually from the soil what it naturally would yield, the crops shielding him from starvation, while the soil was suffered to lie fallow for a great part of the year, and a fresh portion of the food elements was thus converted from the chemically to the physically combined state, and, by the time another sowing season arrived, the soil had recovered its power to yield another crop. But on the introduction of irrigation, the ryot began to raise crops after crops, in succession, thus increasing the call upon the resources of the land, while no time was allowed to prepare the necessary plant-food.

No restoration whatever, or at best only of a most inadequate character, was made of the fertilizing substances withdrawn, What marvel, then, that the soil should yield a diminishing quantity every year, and in time cease to yield a remunerative wheat crop, and compel the ryot to grow an inferior crop—rice? The soil refuses ultimately even to grow that; reeds and rushes take its place; and thus the fatal descent is accomplished. A spoliation of the soil such as is effected by the mode of Indian agriculture, must inevitably end in the results Colonel Corbett mentions in his pamphlet. It is a most dangerous delusion to think that, because the fields of India have for centuries past yielded sufficient food for its millions, they will continue to do so for centuries to come, under the present system of cultivation; for the population of India, we must remember, is constantly increasing, and the additional areas which are now cultivated under the impulse of the rapidly developing export trade of agricultural produce, are but limited. Ample proofs have been given of the exhausted state of the soil, and the facts Colonel Corbett mentions show, how near we are to the end. The present system of stimulating the soil by irrigation, to make it yield its utmost, will inevitably result, as has already been the case, in the more speedy exhaustion of the soil: the larger the crop, the sooner the ruin of the land, and all depending on its fertility.

The extensive irrigation-works contemplated by Government will, if carried out, contribute towards the more speedy ruin of the fields irrigated, unless proper means be adopted to *give back to the soil what is taken from it*, or, in other words unless the ryot lives on the interest of the capital stored up in the soil, instead of drawing an annually diminishing percentage from the stock itself. The *Pioneer* referring to Mr. Buck's paper says:—

> "The cultivator takes all he can from the land, and returns little to it. His ploughs and cattle are wretched, and he can merely scratch with his plough-share the surface of the ground. The lavish use of canal-water, and the consequent over-cropping, exhaust the poorer soils, and may eventually make them sterile. There is less wood in the country, than there was thirty years ago, for wastes have been brought under tillage and fuel has been, and is, in great demand. All this is known to those interested in Indian husbandry; and they are as ready as Mr. Buck to admit the short-sightedness and wastefulness of the practices around them. The difficulty is to suggest a remedy. Meanwhile the present note is a lucid exposition of the principles of scientific agriculture and being in a popular form, will be read and understood by persons who dislike the aridity of a work like Dr. Schrottky's. But the *Gazette* is not seen by the majority of the people who are directly interested in agriculture. Were Mr. Buck's essay translated into the vernacular, sent to the several native journals, and scattered broadcast among landholders and farmers, there might be a chance of its truths being grasped by one or two persons in every district. Even these might not be disposed to treat their lands as the note enjoins; but at any rate, it would set them thinking about the causes which make an acre yield less than it used to. No amount of teaching will do good in a community which has

no wish to improve or grow richer. But there are signs that among the better classes of cultivators and landholders there is a vague desire for agricultural improvement. They are ignorant and timid, and grope blindly about the path of reform. Instruction here is not utterly useless. If only a few of the leading principles of rational agriculture could win their way into general acceptance, a direction and impulse would be given to the spasmodic efforts towards improvement, which may be seen in many a village of these provinces."

THE DROUGHT IN THE NORTH-WEST.

WE are now in a position to estimate the amount of damage actually done by the long drought of last summer and autumn, in the North-Western Provinces. In the feeling of relief which followed the week of saving rain in October, people were perhaps too apt to forget that many difficulties still remained, though absolute ruin had been happily averted. Looking back upon the months between June and October, we notice that they were, in fact, a period almost unparalleled in meteorological annals. Drought in Upper India is no new matter; but drought like that of 1877 is fortunately, very rare indeed. In 1868, the rains did not break till August, but once they had broken, they were not fatally deficient; and the final heavy showers in September were remarkably well timed for the salvation of the crops. It is in truth, the *time* even more than the *quantity* of the rainfall, which decides the year's agricultural prospects. There was a larger rainfall in 1871 than in 1868, yet distress in the latter year, if not more general, was greater because the rains not only began late but ceased early. Last year, we have witnessed other and more startling deviations from the normal course of the rainy season, namely a hot wind throughout the greater part of September, succeeded by general rain from the 6th to the 12th of October, bringing the moonsoon to its close with a rainfall not only deficient, but most unfortunately distributed in point of time. The difference thus caused in climatic conditions, may be estimated from the meteorological returns for September. A period of eleven years including the year 1877, has been taken for the calculation of the average temperature of the month; and this average is startlingly below the corresponding temperature recorded for September 1877, taken by itself. For instance, in Benares we have a difference of 5 degrees, in Allahabad a difference of 6 degrees, in Agra 8, in Jhansi 9, and so on. Such an abnormal temperature was sure to exercise some influence upon the fields, especially when conjoined with an equally remarkable absence of moisture in the air, as testified to by the same meteorological returns. Two crops especially were likely to suffer:—rice and cane. The latter is grown chiefly in Rohilkhund, and the midland portion of the Benares division; the former is distinctively an eastern crop, covering the districts nearest to Bengal, that great home of rice cultivation in Northern India.

What has actually happened last season, is this:—The early rice crop, generally speaking, has perished. At one time, in the beginning of September, there seemed to be a fair chance of a good out-turn, for seasonable showers had begun to fall; but scorching winds followed, and blasted the face of the country. Something, of course, will be saved; but as a food staple, the rice of 1877 is out of the reckoning. The failure of the cane is less complete. In Rohilkhund and the west of Oudh, the out-turn will not be so miserably short as to threaten ruin to the smaller sugar-houses, as is unhappily the case in the great sugar-growing district of Azimgurh. For the other crops of the autumn harvest, the millets and pulses, that which has come off best, thanks to its native hardihood, is the urhur; but the rest have suffered severely. Through whole pergunnahs of some of the eastern districts urhur is the only crop to be seen. In other places, the tall millets—bajra and juar—have come into ear, but the ear holds no grain. The hot winds have left it nothing but a dry husk. Such a *khurreef* has probably not been seen within the memory of the oldest man alive. It is little wonder that in a few districts, something like a panic seized the country people. One must do the poor patient people full justice; they struggled against the forces of Nature as long as they and their cattle were able to hold out; but when the fields grew worse from day to day, when constant toil at the well could not save the scanty patch of cane, or bajra, from slowly withering under the breath of the parching wind; when the under-fed and over-worked bullocks began to give in, and the well-wheel perforce ceased to turn;—it was not wonderful that the people should lose heart, and begin to believe that their only chance of subsistence lay in compelling the village grain-dealer to open his stores. Other circumstances also contributed to discourage the agriculturist. The exceptional plenty of 1875 and 1876, while benefiting the rest of the community, had left him in a worse plight than before; for prices were extremely low, and the grain he could dispose of—a fixed quantity from year to year—was less valuable, and brought him a smaller income. Towards the close of this period, new markets suddenly disclosed themselves in the South and even in England; but the envy of the skies prevented him from profiting by them as he hoped. March and April of 1877 were damp and showery, and the small landowner fearing mildew, was obliged to throw his spring crop into the market, thus checking that rise of prices to which he looked for deliverance. The village banker too, who usually stands by the agriculturist through trying times, has this summer withheld his assistance, whether in apprehension of a wholly exceptional season, or because the grain-stocks, and the money-stocks also, have been perilously reduced by the drain from Madras and Bombay. All these things made the prospect very dark for the poor son of the soil, and we cannot sternly blame him if he shewed signs of a desire to snatch handfuls of grains by force, seeing that neither by labour nor supplication could the work of the fields be made to go on in any tolerable fashion.

It is a curious question, whether the conduct of the people would have become serious matter for anxiety, if that decisive week in October had never been. So far as the so-called grain riots and dacoities had gone, there was evidently nothing political about them. They were the simple expression of the desire of the people for bread exaggerated by the down-heartedness of a moment when their long and weary struggle with the forces of Nature and the money-lender, seemed about to end in ruinous failure. With the first showers in October, all this restlessness came to an end. But if those showers had *never* fallen; if we had been destined to chronicle, not a general failure of the autumn harvest, but the complete annihilation of the *khurreef* crops, and no possibility of growing anything for the *rubbee*,—perhaps the business might have become somewhat more complicated. There are no materials for political disturbance in India, so long as the Government goes on regularly; and this of course the Government would have continued to do. Of disaffection, intrigue, or disloyal propaganda, there is absolutely no apprehension whatsoever; but we are not so sure that we might not have witnessed something very like a national panic. Every one who pays the least attention to the state of the popular mind in the North-Western Provinces, must know very well that it is profoundly exercised at present, in regard to the Frontier question. All kind of wild rumours fill the bazaars, not by any means of the kind which are usually supposed to be typical of Indian political gossip—rumours about the Czar, British interests, and the Sublime Porte; but rumours relating exclusively to Affghanistan, and the immense army which the Amir is supposed to be holding ready for the sack of Peshawur. Whether the result be due simply to the spirit of exaggeration natural to the Oriental mind, or to the successful teachings of Lord Beaconsfield and the Foreign Office, it is undeniably a fact, that the eyes of men in every large city of Upper India are anxiously turned towards the Frontier, and that their minds are anything but easy on the score of an Affghan invasion. Now suppose that this sense of external insecurity had come upon a people whose internal prospects had been darkened by universal famine, we can hardly doubt that the winter of 1877 and the spring of 1878 would have been a period of depression and alarm among all classes of the native community; and that the general feeling would have been such as to merit the title of political. It would have been nothing more or less than a widespread doubt as to the stability of our Government. The people no doubt would have outgrown it; but it would have been a cause of anxiety while it lasted, for all that. However, nothing of all this has happened, and the only puzzle is why so much less is heard about the drought of 1877, than was heard about the less general drought of 1873. Two obvious reasons are to be found:—in the lessons of the Bengal Famine of 1873-74, and the fact that there has been a famine in Southern India during 1877. There is nothing to encourage anybody to make a fuss about the agricultural prospects of Upper India, just at present. The people, again are better off than they were four years ago; grain is generally cheaper, probably from the presence of larger stocks, and the promise of the spring harvest is exceptionally abundant, because a large area of the lost autumn crops has been ploughed up for the *rubbee* sowings. Besides, in the winter of 1873, the North-Western Provinces were beginning to feel the drain upon them for Bengal; whereas now they are beginning to be eased of the drain upon them for Madras. So on the whole, there is no great cause, for anxiety, though distress is felt in some places, and will be felt until the spring harvest comes in. Of course, any injury to that harvest will operate very unfavourably; but we need not begin now to indulge in apprehensions on that score. Very heavy rain fell throughout the North-Western Provinces and Oudh between the 8th and 10th ultimo, and the effect on the *rabi* crops and on the pasturage of the country will be most beneficial. There is good reason, therefore, to hope for such a bountiful crop in March and April, as will carry the people safely on through the rainy season of 1878, which by all known laws, should differ very much indeed from the rainy season of 1877.

MR. ROBERTSON'S REPORT.

THE annual report of the Superintendent of the Madras Government farms for 1875-76, has at last been officially placed at our disposal. It is a matter of regret that the Board of Revenue have not thought fit to give publicity to the report at an earlier date, as much of it, which would have highly interested us a year ago, has lost now greatly its value. The report comprises an unusually large volume containing a full account of a tour Mr. Robertson undertook through the Coimbatore District at the request of the Madras Government, with a view of investigating its agricultural condition and generally collecting information regarding it.

In January 1876 Mr. Robertson started on his tour through the District and returned giving a most gloomy account of its agricultural prospects. Though the population of the Coimbatore District has within the last twenty years increased by 55½ per cent., its prosperity has by no means increased in a like ratio, nor have its agricultural processes improved, so as to bear the strain of an augmented population. It is true that the total area under cultivation has, within the last thirty years, increased by 50 per cent., but the average rent has decreased from one rupee and five annas per acre to fifteen annas, ten pie, while throughout the District, the ryots agree in stating, that the unirrigated land has diminished in productiveness fully 30 per cent. during the past 25 years. Special pains were taken to sift statements made regarding the deterioration in the fertility of land, but Mr. Robertson says, he could come to no other conclusion, but that *this deterioration has taken place and to a very alarming extent;* while, it appeared to him equally certain, that the influences which have brought about this result are not only still in operation but are now operating in a much more intensified form.

But for these circumstances, the large increase of rent-paying land would be a satisfactory proof of agricultural progress throughout the district, taking, however, the increase of population and of area in cultivation conjointly with the decrease of rent and of average yield per same area into consideration, we find that the district produces now about 30 per cent. less of foodstuffs per head, than it produced 30 years ago, which means, of course, a general impoverishment of the cultivating classes, and a degeneration of the only half-fed cattle. And to further bear this out, we find from the figures given that, whereas in 1838-39 there were 65 cattle per 100 acres of occupied lands, there were in 1871-72 but 42 heads to the same area, and Mr. Robertson says:

"Everywhere I went, the ryots declared that there has been a great diminution in the live stock of the District. Since returning to Madras, I have carefully examined the statistics of Coimbatore and I have ascertained that, *in the last* 30 *years, the area under occupation has been increased* 50 *per cent. while, there has been but little change in the number of live stock*; hence compared with the area of land now under occupation there has been a large decrease." And this could not well be otherwise, *for during the last* 18 *years* 700,000 *acres of land, growing jungle, scrub and coarse grass,* which supported a large number of cattle, has been brought under the plough. The large decrease in the average rent of unirrigated land which statistics show to amount to nearly 30 per cent., in the last 18 years, is not, Mr. Robertson thinks, due to any reduction in the rent, but, to the large addition to the unirrigated area of inferior land paying low rent, which necessarily reduces the average rent of the whole. He says on this subject:

"Of course, the pressure of an increasing population, will gradually force under culture more and more of the unrented land. We have seen that during only 18 years, this increase has amounted to 700,000 acres, and we may expect that this gradual appropriation of the unrented land will go on until, probably, the whole is taken up for cultivation Now, it is certainly far better that such land should be under tillage in Districts circumstanced like this, *but, the absorption under tillage of the whole of the ryotwary land, will destroy the resources upon which the ryot has hitherto depended so greatly.* Under the inferior agriculture practised, the recent large increase in the area under tillage is, I think, a cause for serious alarm; for, whenever an unpropitious season occurs, the cultivators of this newly added area, which is, nearly always composed of inferior soils, have nothing whatever to rely upon, and they, as well as those connected with them, have to seek other means of support which, in some seasons, they cannot obtain except by Government establishing relief works. The 700,000 acres of land, added, during the past 20 years, to the area under cultivation, will probably be occupied by not less than 60,000 families. As long as only the moderately good soils are tilled, a rude system of husbandry may suffice to meet the wants of the cultivators but, *directly the inferior soils are taken up for culture, it becomes necessary that an improved agricultural practice should be adopted.* The land, that has recently been added to the cultivable area, is undoubtedly very inferior, and it is being cultivated in precisely the same rude way as the better soils, of which previously the cultivated area chiefly consisted."

Our statement that the greater portion of the cultivated soil throughout India never receives any manure whatsoever, and that the rest belonging chiefly to the home culture of the ryot receives but an inadequate one, has been received with some incredulity. Mr. Robertson, however, bear us out in our statement and he shows clearly that so far as the Coimbatore District is concerned, 75 per cent. of the occupied land never receives any manure, while his figures only go to show that the remaining 25 per cent. *can* be manured, but take no recognisance of the *quality of the manuring*.

Mr. Robertson seems, throughout his tour, to have been impressed with a most gloomy view of the agricultural prospects of the Coimbatore District, and the Board of Revenue has probably delayed the publicity of his report so long, in order to minutely enquire into the correctness of his statements. That the agricultural condition of the whole of India, excepting only the periodically inundated districts, resembles more or less the agricultural condition of the Coimbatore district, we were persuaded long before Mr. Robertson made his tour, neither ought his report to have surprised Government, for it is not the first time that its attention has been drawn to this decline in the fertility of the Indian soil and intimately connected with it, the decline in the prosperity and condition of the native cultivator and his cattle. More than ten years ago Mr. Elliot, stated that the out-turn of wheat in the Nerbudda valley, as rich a soil as can be found anywhere, had declined during the last fifty years from ten and twelve-fold to six-fold and that the agricultural production of the districts was only kept up by constantly bringing new land under cultivation, a resource which is diminishing every day. Our readers may form an idea of the richness of the soil by the fact, that it will yield remunerative crops of wheat for thirty or forty years without manure, without rotation, without fallow, before giving signs of exhaustion.

Well may we pause before these revelations: they claim for action, for immediate action, and it will not do to ignore the fact by reason of its very magnitude. Government cannot afford to let things remain in *statu quo*, and must make an earnest beginning to improve the agricultural condition of the country. Where this beginning should begin, we have shown more than once.

The way is not unknown, it has been trodden by other countries, and success and prosperity have followed in the wake. We shall endeavour to publish in our next issue, the most important portion of Mr. Robertson's Report on his agricultural tour, and notice then also the second part of his report, dealing with the progress of the Government farms.

THE OLDEST METHOD OF IRRIGATION.

It is now pretty generally admitted that if the present *laissez aller* policy is continued by us, the Government of India must reckon with a famine, or at least a scarcity of some kind somewhere, twice in the course of a decade. It is also tolerably certain that this would not be the case, if the effects of drought could be artificially neutralised. But having got thus far, we enter upon a stage of the argument where all agreement ceases. Whether irrigation can be made to pay; what kind of irrigation should be adopted; and whether all irrigation does not ultimately exhaust the soil—these are the questions which now engage our attention. It used to be the fashion to extol the great tanks of Southern India, as the works of dynasties better acquainted than ourselves, with the real requirements of the country; but since the failure of the water-supply in those parts this year, lakes, tanks, and embankments have sadly suffered in prestige. The reaction of opinion was natural, but probably not quite fair; for it is possible that a tank system, on the great scale of which traces still remain, instead of the comparatively small scale now in work, might prove really efficient. The magnificent canals of Upper India again, may almost be said to be still on their trial. They gave a splendid example of what they could do four months ago, when the shadow of famine was stretching more and more darkly over the land, and from all sides came reports with this sole note of encouragement—that as far as canal-water could reach, the crops were safe. But the principal objection to great irrigation schemes, lies in their expense. Taking them for all in all, nobody can seriously deny that they do a vast deal more good than harm, the good being essential and the harm merely incidental.

There is, however, one kind of irrigation against which no objection can be urged, except that it is laborious and limited in operation. This is irrigation from wells. Wells have two advantages; they do not produce *reh*, because they produce downward filtration, not upwards filtration, as in the case of water-courses or tanks, built above the level of the surrounding country, tending to deposit salts over the face of the fields. Secondly, wells cost the State nothing. All that is wanted, and even that not in all cases, is a temporary advance to the landholder, with some slight indulgence in the matter of the next few years' revenue. Against these advantages, are to be set the waste of time and power involved in hauling a bucket up from unknown depths of the earth, by the painful exertions of the common country bullock, a beast which shares to the full the Homeric quality of cattle, that of tediously trailing the foot, as if each step were to be his last. For this reason, it will not pay to sink a well at all in some places, for the purpose of irrigation only. Forty-five feet may be roughly taken as the maximum depth of the water-level in this respect. But wherever the depth of the spring level does not exceed this, the security of the harvest depends simply upon the number of wells. A passage in one of Sir Richard Temple's Madras Famine reports, bears striking testimony to this. "While most of the tanks or lakes," he writes, "which ordinarily fertilise the best lands, have remained empty during this drought, the wells have been the means of drawing water from those subterranean reservoirs which the granite formations and the various rocky strata retain, preserving the moisture of previous times. It is noteworthy in most parts of the Madras Presidency that wells, if deepened, will still produce springs of water despite a drought certainly of one year, and probably of two years. One of the best prophylactics against famine next to deep cultivation, then, is to encourage the excavation of wells more and more. The experience of 1876-77 has, as already mentioned, imparted much impetus to the sinking of wells throughout the country. It is to be hoped that the Government will be able to maintain this impetus in years to come."

'Granite formations and various rocky strata' are not to be found all over India, and if the success of well-irrigation depended upon their presence, the experiment would be a hopeless one throughout the entire Gangetic basin. But 'subterranean reservoirs' preserving 'the moisture of previous times', exist in clay and *kunkur* as well as granite; and the wells of Northern and North-Eastern India, are equal to those of the South in holding out, with a little help from the spade, against a two-year's drought. Of course, they must be made of masonry, for the common *kutcha* well is an exceedingly short-lived structure; and a masonry well costs something more than the majority of small landholders are usually to give. This brings us to the question of State advances, or *tuccavee*, as they are called, to be recovered at rates very different from those which govern advances obtained from the village money-lender. Such State loans are regulated in Northern India by the Land Improvement Act of 1871, an Act which has, until lately, been somewhat restricted in its operation by the want of rules for giving effect to its provisions. These rules, however, now exist, and enable the tenant or owner of land to borrow money enough to build a masonry well—that is, a sum of from Rs. 500 to 600—by a simple application in writing to the Collector, pledging security which exceeds the amount of the loan by at least one-fourth. The rate of interest is 6¼ per cent, and the principal is to be repayable in not more than seven years. These provisions are sufficiently simple and liberal. Besides the Land Improvement Act, there are other means of helping the agriculturist who wishes to secure his fields against drought. For instance in assessing the land-revenue, it is easy to spare a landowner who has turned dry into irrigated land by sinking a well upon it. The practice hitherto followed has been to count such land as unirrigated for a certain number of years, thus giving the holder the benefit of more favourable rates. Something, too, can be done in the way of scientific assistance of an elementary nature, such as impressing upon the uncultivated agricultural mind the fact, that circles vary in area according to the squares of their diameters, and that, consequently, if a well three feet across gives room for one leathern bucket, the diameter of the well which shall accommodate two, need not be six feet, but only four feet four and-a-half inches. Probably, however, this truth is already familiar to the Indian son of the soil, who has learned it by the practical process commonly called the rule of thumb. After all, it is chiefly the Land Improvement Act, with its new rules, to which we must look for the multiplication of wells. District officers may scour the country, with scientific facts neatly packed into vernacular pills for the small zemindars' mental digestion; but he will most likely prefer to trust his own experience as to the depth to which it pays him to sink a well, the quantity of water he can raise on an average daily, and the extent of land he can irrigate. If he can get money on easy terms, he may perhaps be induced to undertake well-sinking to an extent hitherto unheard of; and in keeping his attention directed to the *tuccavee* rules, Collectors may do some really useful work. A statement of wells is, we believe, one of the many tabular returns affected by most local Governments; and it may be that a larger area of foolscap will be covered by its columns, since the recent revival of interest in the subject to which they relate. We may at least hope so; and in the meantime we may be sure that however small the increase of wells, every new well is so much gain. The great problem of the Indian food-supply will not in all likelihood be solved by sinking any number of masonry shafts; but that is no reason why effort in this direction should be regarded with indifference, as an auxiliary guarantee against famine, though they can never claim rank as a prophylactic (to borrow a word from State papers) of the first order.

If wells were indeed able to claim such a distinction, the fact would not be without a peculiar interest of its own. Here in India, we have a vast community, cared for by rulers who represent the highest point yet reached in human progress. This community is exposed to a danger, for which those rulers vainly seek a remedy in all the teachings of modern science. And, behold! the problem is to be solved by the oldest of expedients, dating from days of the primal relations between man and the physical forces of Nature. There is still something of the old sanctity about the well—that first effort of infant engineering, hallowed in our minds by old legends and quaint Scripture stories. If we look to another country, with India's area and climate, but not a fiftieth part of India's population, we see there also that which reminds us of four thousand years ago, when Abraham advanced into the empty East, digging a well at every halting-place. The country we mean, is, Australia. One of the chief characteristics of that island continent, is its vast extent of rolling downs, without pool or stream, at which the wayfarer can slake his thirst. Wells must accompany civilization, and the man of the nineteenth century must secure every successive conquest over Nature, by the same means as were used by the man of forty centuries before him. We might push these reflections further, and find in this fact one more instance of that strange approximation of the highest developments towards the rudest beginnings, which has threatened to make barbarian hordes, fighting in the modern style and with modern arms, again a source of uneasiness to civilised nations, and has put in the mouth of drawing-room philosophers, as the very newest gospel of science, the crude physiological theories which amused Epicurus. But enough, we hope, has been said already for our purpose, which is to draw attention to one out of many fancied solutions of the problem of feeding India. Henceforth we may expect that this oldest system of water-supply will meet with greater respect than it finds in a recent treatise on irrigation, where the place of honour is accorded, not to wells, but to dykes, and the writer begins his table of contents with the somewhat startling outburst 'Dam irrigation.'

BAMBOO AS PAPER STOCK.

MR. ROUTLEDGE, the eminent paper manufacturer who, our readers will remember, has in view the utilisation of young bamboos for paper stock, and purposes to cultivate them for this object in British Burmah, has lately written to the *Rangoon Gazette* regarding his enterprise as follows:—

"A friend in India has by this Mail sent me a cutting from your journal (when published I do not know) which states "you understand that the manufacture of the *paper* from the Bambusa "on Mr. Routledge's principle has proved almost a failure &c. &c."

I trust you will allow me space to point out that the failure has not been *in making paper* from bamboo, which was never attempted, but in getting the crushed bamboo stems sent home to me in England so that our works here might manufacture them on a practical working scale into "paper stock" and Paper.

The "manufacture of paper" therefore in Burmah was in reality —*Nil*; but that paper of excellent quality can be made from bamboo is evidenced by my Pamphlet on the subject (of which, I mail you a copy) printed thereon, as also by the sheet on which I am now writing—both the result of my first experiments, which although conducted under somewhat disadvantageous conditions were so satisfactory to my mind (as a practical paper-maker) proving that bamboo properly treated is a first class material, that I am most anxious to see it fairly introduced to our trade, now mainly dependent on esparto grass far inferior to it in quality.

You will remark, I state in my Pamphlet that owing to its bulk and extreme lightness bamboo cannot possibly be imported in its raw, or natural condition, even when crushed; it must therefore be converted into "paper stock" (a tow-like condition of which I enclose sample) *in situ* or near where it grows or is produced, and of all countries Burmah offers the greatest facilities for this industry, its climate inducing production to an almost illimitable extent with economical transport by water at cheap cost to a port of shipment.

The machinery which I was empowered to send out by Government consisted merely of rolls for crushing and splitting the stems. These I learn, when driven by bullocks, or manual labor, the motion being too slow, broke down, but worked subsequently by steam-power did satisfactory duty, as a considerable number of stems were crushed: unfortunately however the arrangements I considered I had made for having them sent home to me as "dunnage" were not carried out; thus these crushed and dried stems were spoilt and the expenses incurred lost.

I have every reason to believe the experiment will prove more satisfactory this present season and, I hope, result in the establishment of works to inaugurate this new industry of paper stock.

Once commenced I fail to see why bamboo converted into a fibrous staple, should not assume as prominent a position as jute has done, and while thus adding to the exports and material prosperity of our Indian Empire preclude or at least diminish the present necessity which rules in our English paper trade of procuring our supplies of material from foreign countries.

P. S. The stock, sample of which I enclose, such as I propose to prepare it, will be press-packed in the same manner as jute or cotton, for economy of freight.

In connection with this we may opportunely place before our readers the experiments made by Dr. King, of the Calcutta Botanical Gardens regarding this subject. Referring, to the great expectations put forth by Mr. Routledge, that in the young shoots of the bamboo he had found a raw material which, by a simple treatment in its native country could be transmitted to England in a rough dry state for final manufacture, Dr. King says in his report for 1876-77 "it is essential to the success of Mr. Routeledge's process that the bamboo shoots be quite young and succulent, and the great difficulty which at once presented itself to persons with any knowledge of the modes of growth of Indian bamboos was, that such shoots, being produced in moderate quantity from each clump, and only during a limited season of the year, the proposed paper stock-making machinery must, for a large part of the year, necessarily lie idle. To meet this difficulty, Mr. Routledge suggested that bamboo clumps might, by proper treatment, be induced, after most of their old stools had been cut away, to send up from the stools thus bared, regularly and irrespective of season, crops of succulent shoots suitable for conversion into paper stock. Mr. Routeledge's expectations implied a very complete change of habit in the bamboo; for it is pretty well known that bamboo clumps, if entirely cut down, yield for several years but few small succulent shoots, and, in fact, not unfrequently die. In order, however, to submit the proposed scheme to a trial under my own eye, six clumps of bamboos were cut down last year at the beginning of the rains (*i.e.* between the 10th and 20th June), when the buds of the young shoots of the season had completely formed and were nearly ready to burst through the soil. Soon after the cutting of the old stems, these buds developed into shoots, which grew with characteristic rapidity. These were allowed to grow until they began to show symptoms of becoming hard, and on 21st July they were all cut down. They were at once weighed with the following results :—

Clump.	Number of young shoots.	Weight in pounds,
No. 1	11	160
,, 2	7	102
,, 3	6	78
,, 4	9	100
,, 5	5	42
,, 6	12	198
Total ...	50	680

This gives an average of 113 pounds of wet young shoots per clump. The time of cutting was the most favourable that could have been chosen, and the crop of shoots yielded was probably as good as it would have been, had the clumps remained untouched by the knife. Judging from the size of the clumps, I calculated that at most 80 similar clumps could be grown on an acre of land. This allows an area of 576 superficial feet to each clump, and such close planting would probably necessitate manuring. Taking the yield of these six clumps as an average, and excluding all loss from death and accident, the yield of an acre during the first year of cutting, would be 9,066 pounds of fresh young shoots. It must not be forgotten that freshly cut bamboo shoots are extremely succulent, and that the amount of dry paper stock that could be got from them, would bear a very small proportion to their original weight. An additional difficulty that attends the scheme is that, since only fresh succulent shoots will answer, and as these are of too high specific gravity to float, the cost of land carriage to the factory (a very heavy one in Bengal) would have to be incurred. The cut clumps above referred to were well cared for; leaf mould and tank soil were laid round them, and, as compared to similar clumps in the forest, they had the great advantage of immunity from fire, and from being grazed on by cattle. Since these young shoots were cut, a considerable number of woody twigs have arisen from the bases of the old stems. No fresh young root shoots have however, appeared. Some such will, doubtless, appear at the usual time, which would be the beginning of the ensuing rainy season. These shoots shall be cut at the time recommended by Mr. Routledge, *i.e.*, when they are just beginning to become hard and woody, and with the cutting of these the crucial part of the experiment will begin," the results of which will be recorded in Dr. King's next annual report.

There are, therefore, many reasons for doubting, that Mr. Routledge's sanguine expectations of obtaining from young bamboos a *cheap* paper stock, will be fulfilled; good paper can, no doubt, be made from it, but herein lies the point of failure :—it will not pay. We cannot say, we are sorry that it is so, for it will draw attention to other material, which unlike the bamboo, is totally neglected, and the utilisation of which would be one more development of the resources of the country which we are so much in need of. We refer to the hundreds of square miles covered with coarse grasses, suitable for paper stock, to be found in the Soonderbunds, the *churs* of the Brahmaputra, and similar localities, which nature without aid, without cultivation, yearly reproduces; we have seen most excellent paper made of similar material along the Bombay coast, and and we invite Mr. Routledge to come and verify our statement.

EDITORIAL NOTES.

The Famine is officially declared to be at an end.

We have received from Messrs. Higginbotham & Co., the Madras Publishers, a *Handbook of Common Salt*, by Dr. Ratton, which requires some notice at our hands. Pressure on our space necessitates our deferring it till next issue, but we cannot say, we have been favourably impressed by it, considering that Dr. Ratton was employed by the Madras Board of Revenue for *five* years, in the investigation of salt manufacture. Not only is the treatment of the subject not such, as we have a right to expect from an officer who is supposed to have thoroughly studied it for a period of five years, being specially appointed for that object by Government, but the typographical and other similar errors with which the Book abounds, speak of great carelessness and indifferent editing which is discreditable to the author who, if his own time was not sufficient, should have employed a competent person to edit the book for him. If this *Handbook* embodies every thing Dr. Ratton has learnt on salt, during the time he was on special duty, and is a digest as well of his official reports, we cannot congratulate the Madras Government on the selection they made; for Dr. Ratton's *Handbook* tells us of very little more than we knew before, shows us that he has entirely neglected to study the processes of salt manufacture, carried on to such perfection in Germany and in France, though he personally inspected some of the salines in the latter country, shows us that he knows absolutely nothing of the literature of it, while his statement that he had failed to obtain any work on the subject, either in Europe or in India, by no means exonerates him. We are aware that no special English literature exists on the manufacture of salt, though excellent treatises on the subject are found in works on Applied Chemistry and in Encyclopedias, but in French and German, we have a distinct literature on the subject, and with a little trouble, Dr. Ratton might have learnt all about it. We shall refer to the subject fully in our next issue.

In contrast to the above, we desire to draw favorable notice to 3 volumes on Meteorology just published by the Superintendent of Government Printing in Calcutta. They consist of the "*Indian Meteorologist's Vade Mecum*," Part I. and II, and of a volume of "Tables for the Reduction of Meteorological Observations in India" by Henry F. Blanford, the Meteorological Reporter to the Government of India. They are three as carefully edited volumes as any we have seen published in India, and show throughout the thorough comprehension on part of the writer, of the subject he deals with. In completeness and practical exposition, Mr. Blanford's work may not unfavourably be compared with Herschell's Meteorology, which is considered *the* standard work on the subject. Meteorological observations have always been considered, in modern as well as ancient times, to possess the greatest possible interest to the agriculturist, whose success, or failure, depends so often on wind and weather, and a great many of our readers keep a Barometer, Thermometer and a Rainguage for regular observations of atmospheric phenomena, and we recommend to their special notice these three volumes. As Mr. Blanford says in the introduction to his work, meteorology requires the same care, and the same precautions, that are demanded in all experiments and observations undertaken for the discovery of physical laws. It might be thought that so obvious an inference would scarcely need insisting on, and yet it is unquestionable that very many of those persons who keep a regular register of the readings of meteorological instruments, and who even devote much time and attention to the occupation, practically ignore it, and incur much disappointment when, perhaps after many years' assiduous labour, they are told by some one who has vainly sought to turn their registers to useful account, that owing to the neglect of a few simple precautions, the whole of those results are of little or no value. A Barometer and a Thermometer are instruments of simple construction, and any person of ordinary intelligence may be taught in the course of a few minutes how to read them accurately. But it is of little use to be able to read them, unless we know exactly what is the physical meaning of the readings we record; in other words, unless we know how that particular condition of the instrument which is expressed by each reading, has been brought about; and (since, in all cases, many causes have been at work to produce it, while we want to measure only one of them), unless we can eliminate all that is foreign to our purpose, and so ascertain that one measure truthfully, or within assignable limits of error.

The first volume of Mr. Blanford's work, is intended as a guide to those who keep a meteorological register, and he has purposely refrained from entering on the subject of meteorology as a science; at least has not gone further than is necessary for the due understanding of the methods of recording observations. In the second volume, Mr. Blanford has entered upon some of the more important laws of pneumatics and thermotics that regulate meteorological phenomena, and he has given such a sketch of what is known of Indian meteorology as will serve as a groundwork of information, for those who may desire to engage in the further study of the phenomena around us. Now that we have this really valuable *Vade Mecum* for the Indian meteorologist, we should desire to see the work in the hands of every one, who is in the habit of recording the natural phenomena of wind and weather.

A SETTLEMENT officer writes us on the exhaustion of canal irrigated lands :—"Cultivators have occasionally informed me, that the productive powers of their land, have fallen off after a few years of canal irrigation." The writer further on observes :—"I am not prepared to hazard any decided opinion, with my present knowledge, but I would back first-class land, sufficiently watered from wells, *against* the best canal irrigated fields, at all events, for a crop of wheat. *Vide* letter of "SHEFFIELD" to the *Pioneer*, republished in *The Indian Economist* of the 15th May 1871, page 277-78. "SHEFFIELD is quite right, and if the land were previously limed, not only would the produce be very much greater, but infinitely superior in quality."

WITH reference to the prize now offered by the Supreme Government for the best machine to prepare the Rheea fibre for the market, the Madras Government tells us, that since the trial of the Rheea Fibre Machines at Shaharanpore in 1872, a new Rheea Machine has been invented in America, which seems to perfectly meet the want. The machine is referred to, by the Commissioner of Agriculture in the United States, in his monthly report for December 1875 as follows :—

"At the late Mechanic's Institute Fair in San Francisco, Mr. C C. Coleman, of Honolulu, Sandwich Islands, exhibited a machine of his invention for the preparation of the fibre of the Ramie Rheea or China grass. From the description given, the process appears to be very simple. The plant, freshly cut at its full-ripe stage, is passed through a series of rollers, being carried along by moving wire screens. It dips into tanks filled with steam, hot water, and bleaching chemicals. Rollers crush the plant and squeeze out the glutinous matter which is absorbed by the water and steam. The mass is passed through the machine as often as may be necessary to disolve and remove all the extraneous gum and other elements and to bleach the fibre itself. After each submersion it is passed through rollers which squeeze out the water with the matter it has absorbed from the plant. It is not even necessary to remove the leaves, as these are separated by the machinery. The fibre is not broken nor even weakened by the process. This is an immense reduction of labor from the manual process of India and China, where a workman does well if he secures a pound and a half of clean fibre per day, making its cost about 150 dollars per ton. If this machine should realise the expectations of its inventor, it will solve at once the problem of Ramie [Rheea] production in this country. It is claimed that large tracts of land in California will average 1,250 pounds of pure fibre per acre, calculating it at 10 per cent of the entire bulk of the plant. Others estimate the yield of fibre at only 5 per cent, and the truth lies probably between the two estimates. The prepared fibre formerly exported from California to England passed through the Custom-house at a declared value of £9 to £80, or $45 to $400 per ton. it is claimed that Coleman's machine will clean the fibre at a cost of $20 to $30 per ton"

AT a General Meeting of the 'Anjuman-i-Punjab' which took place at the new Government College Hall, Lahore, a week ago, one of the subjects for discussion was to have been the establishment of a school of agriculture or of agricultural classes. We have not yet heard of the result, but we trust that the Anjuman will be successful in establishing such a needed institution.

OWING to the extraordinary character of the season, the field work on the Madras Government Farm, was carried on in the last official year under very adverse circumstances. But the results are recorded of useful experiments made with various indigenous crops, and with seed imported from Australia The experience gained by several years' cultivation of New Orleans cotton, is likely to prove very valuable, and the Government await with interest the result of the attempt that is to be made to induce the plant to alter its bearing season. The qualities of the [illegible] grass, as described in extracts from Australian and American sources, render it probable that it could with advantage be planted on canal banks in this country. The experience gai[illegible] its further cultivation should be carefully noted for communication to the Public Works Department.

WE are glad to learn that Mr. Rice, the Director of Public Instruction in Mysore and Coorg, has requested Mr. Harman, Superintendent of the Bangalore Experimental Farm, to write a text book on Agriculture, for use in the village schools of the province. The idea is an excellent one, says the *Bangalore Spectator*, and the carrying out is calculated to be attended with good results. All the experimental and model farms in the Peninsula, will not wean the natives from the patriarchal processes of agriculture they have followed for centuries. If we would induce them to take kindly to modern improvements in agriculture, we must afford them instruction in the science : and the next best thing to establishing an agricultural school or college, is to introduce the theoretic study of agricultural science, into the curriculum of studies in the provincial and village schools While on the subject, we would impress upon the Chief Commissioner the importance of disseminating among the ryots and landholders in the province, all available information relative to the operations of the Government Experimental Farm in Bangalore. A limited number of copies of the last annual Report of the Superintendent of the Farm, have been struck off in *English* only, for circulation, we presume, among Government officials. This is not enough ; such limited publicity will not reach those whom it most concerns—the farmers. We would strongly recommend that a number of copies of the report be printed in Canarese, and circulated throughout the province. It were better to close the Farm altogether, than to confine its operations, and shut the public out from a participation in the knowledge of what is going on. At present the object for which the Farm was started is defeated, and it is a reproach to the present administration.

A TERRIBLE calamity has, the *Bombay Gazette* hears, befallen the people of Cashmere. The rice harvest which was very abundant, had not been gathered, owing to a dispute between the cultivators and the Maharajah's collector of land revenue, who would not let the grain be cut till the assessment was fixed at a higher rate than that of former years, when the snow came down and completely destroyed the ripe crops. A traveller who came from Cashmere a short time ago, tells us that he never saw a more piteous spectacle than that of the hundreds of people in every village crying helplessly for the loss of their whole food-supply for the winter. Cashmere usually imports no grain, and it is unlikely the Maharaja will trouble himself to depart from the ordinary custom now ; so the consequences to his wretched subjects will be deplorable.

THERE has apparently been a marked failure of the rice crop in Siam at all events the Siamese Government have prohibited the exportation of that cereal for the term of one year, with the assurance, however, "that the prohibition will be withdrawn at the earliest possible date if the next crop should prove satisfactory."

WE learn that news has been received in Rangoon to the effect that the paddy crops at Chittagong, have been almost universally destroyed by locusts and insects. This misfortune is counterbalanced by news that in the Arracan division a bumper crop is expected. Labour in Arracan will therefore be probably more plentiful next year on account of immigration from Chittagong, where the crops have failed.

WITH regard to the new cotton crop on the Bombay side, one of the local papers tells us that, "the reports from the districts have been by no means satisfactory this week, and point, on the whole, to a smaller yield than was a short time ago deemed probable, In the Oomrawuttee districts several showers have fallen, which, although they will not reduce the quantity of the crop, will probably affect the quality, and we may look for the bulk of the arrivals during the next month or six weeks at least showing a large proportion of black leaf. From Broach, the general estimates do not put the yield at more than three-fourths of an average. Hot weather during the day and the absence of dew by night has tended to bring the plant to maturity too rapidly, and the result, so far as the first picking is concerned, will be a light wasty staple. From Dholera there is nothing to alter our previous estimates of the growth, which cannot, under the most favourable circumstances, prove more than, if as much as 75 per cent. of a full crop. Compta and Dharwar are still well spoken of."

The tribes of the Hill Tracts of Arrakan within our administrative boundary, are now all settled along the banks of these two great rivers, and when the rains subside, they leave a fine alluvial soil that will grow almost anything. The teak tree, though not indigenous to the Tracts, seems to thrive well, and the Report tells us of a large plantation on the Lemroo of 46,000 trees, planted and owned by an enterprising Shan, who values his holding at Rs. 10,000 to Rs. 15,000, although it is but 5 years old, and the total cost of the plantation is said to have been but Rs. 3,000. By placing a couple of steam launches on the Koladyne, and drawing English enterprise and capital to the Tracts, we should add to the empire a district that would soon rival in wealth and prosperity our older settlements. The Report tells us that an application was made during the year by a European gentleman for 10,000 acres of land; and if the land is taken up for *bonâ fide* cultivation, and not for jobbing purposes, a lease will no doubt be granted. Tobacco is at present one the great staple product, and an experimental farm is or was about to be established by the Government in the Tracts, for ascertaining the best methods of culture and care. Almost the whole population at present are engaged in *jhoom* or *toungya* cultivation, the process of which is described as follows :—

"About December or January, a rich, and where procurable, virgin, piece of land is cut clear of every tree, bamboo, or shrub on it, which by the end of April has under a fierce Burmese sun become almost as combustible as powder This is fired, and a few days afterwards is sown a mixed crop of paddy, cotton, pumpkin, and other vegetables, which are in about five months' ripe for stowing away. On the termination of the rains, Nature has been so prolific in her gifts to the hill-man, as to enable him to pursue in a very simple and easy manner another profitable culture, *viz.*, that of tobacco sown on the rich alluvial deposit formed along the river banks on the subsiding of the water. The tobacco seed is sown in November, and the crop is fit for plucking by April. Thus during the year the hill tribes are engaged in two distinct methods of cultivation."

We are sorry to learn that a blight has fallen on the gram crop in some parts of Mysore; the crop had been promising well up to a late date.

We hear from Ceylon that the Cacao enterprise is likely to assume considerable dimensions Cacao is being planted now to fill up the vacancies of a great many Coffee estates and several parties have applied for blocks of land at Caltura, at the sea-coast, with the view of devoting it exclusively to the cultivation of Cacao.

The Horticultural Society of Mysore, will hold a show of Flowers, Fruits and Vegetables at the Lall Bagh, Bangalore, on the 15th January.

The Nerbudda valley agricultural show, 1877, held in the beginning of December last, on the sands of the sacred Nerbudda opposite the village of Buman. has been a great success. There was a good display of field and garden produce and also of live stock Of the latter the horses attracted most attention, and among field produce wheat, for which the Nerbudda district is famous, occupied the most prominent place and a large number of exhibitors were entered under this head.

The resources of Arracan, mineral and agricultural, are beginning to attract the notice of Government and private individuals. Arracan is a large rice-producing district; but other sources of profit which have been neglected for years have now been discovered to exist. The Borongas can produce finer earth oil than even the wells of Yenangyoung, and its capacity and yield is about to be tested by Mr. Gillam, an enterprising gentleman who sometime ago had applied for a grant of 10,000 acres in the Hill Tracts to grow tobacco.

We are sorry to have to announce the death of Mr. G. A Cruwell, one of the pioneers of coffee planting in Ceylon. Mr. Cruwell's career in Ceylon, was to a larger extent than that of most of his compeers identified with the rise and progress of European planting enterprise in Ceylon, and to him belonged the honour of giving the first great impetus to the cultivation of Liberian coffee in India and Ceylon, for his visit to the coast of Western Africa and purchase and transmission of seed, opened up a communication which was at once taken advantage of by planters and mercantile men.

We understand that with a view to an investigation of the new alkaloid, Quinamine (discovered by Hesse a few years ago, in the Himalayan bark, and which has never been met with in South American barks), the Secretary of State, on the motion of Mr. Clements R. Markham, has requested that about 20lbs. of the febrifuge as prepared at Darjeeling, may be sent home. Very little seems to be yet known with regard to the action of this alkaloid, and it is thought very important that its action on the human system should be carefully studied.

Very satisfactory reports are published concerning the growth of the cinchona tree in Jamaica. It appears that the seeds were first sown in that island in 1860, and now, after seventeen years, 300 acres of land are occupied by plantations. No fewer than 80,000 trees are now well grown, and the seeds of those trees are already sowing themselves far and wide over the country. When we remember how terribly Jamaica has suffered, and even now at times continues to suffer from malarious fevers, it seems extraordinary that so many years should have been allowed to pass since the Jesuit's bark first became known to Europeans, before it was transplanted from the American mainland to the island of Jamaica. It is very nearly three centuries since the Marquis of Cinchona was Viceroy of Peru, and it is to him the bark owes its name and European reputation.

We are informed that steps are about to be taken to obtain a quantity of good tobacco seed from America, for cultivation in the North-West Provinces. The seed is expected to reach India in time for this year's sowings.

Cigars are now being made at the Cape of Good Hope, but only for local consumption. A gentleman named Coot Zevanepol proprietor of the farm Zevenfontein, Smithfield, exhibited at the recent Cape Exhibition some very good cigars, made of tobacco grown by him, and which, though light coloured, possessed a good aroma and flavour.

The drought during the past year or more, has necessarily affected the cultivation of the tobacco plant in Madras. The Trichinopoly cigar merchants complain that tobacco, of even moderately good quality, cannot be obtained, and the statement will be readily endorsed by many a lover of the "grateful weed," who is tempted to buy the "best Trichinopoly cigar" at high prices, and finds it the reverse of fragrant or pleasant. Some time ago, a company was formed at Dindigul, with the special object of cultivating a good quality of tobacco, and manufacturing a superior specimen of cigar But, during the past year, its hopes and expectations of success must have been considerably blighted. Taking into account the large demand for good cheroots for the use of clubs, messes, and the large smoking section of the community, it seems surprising that greater and more successful attention is not given to the cultivation of tobacco, and its manufacture into such products as will find a ready sale in the market.

We receive very bad accounts of the potato crop, which seems to have partially failed in most of the potato growing districts. Disease and heavy rain seem to have effected the crop in Bangalore and Ootacamund, Delhi and Agra in the North not being much better off. We trust the attention of Government is directed towards obtaining speedily a large supply of fresh seed potatoes from Government farms for distribution to the public.

The manurial value of oil yielding plants, is thus noticed in Mr. Harman's pamphlet:—*Oil-Seeds* —The extent to which these valuable seeds are grown appears to be confined to home consumption. The production of oil for export is much to be encouraged, as it robs the soil of no mineral matters, its chemical constituents being entirely atmospheric. Several of the oil-bearing plants are valuable manurial agents, their leaves retain a large proportion of valuable products derived from the air, which on the leaf decaying, enrich the ground on which the plant has existed. On the other hand, the export of oil seeds is much to be deprecated, as the husk and residue, after the expression of oil, is exceedingly rich in manurial matter. The enormous rise in price during the last few years of manurial oil-cakes for export to the coffee districts, is a sufficient proof of the value in which they are held by planters. There can be little doubt that the temptation of immediate return by the sale of these articles will in time seriously affect the yield of wet land crops. Before the demand had become as strong as it now is, these cakes were within the means of the mass of the ryots to procure, and were extensively used both for manure and fuel. Now instead of being used where produced, they are sold; but whether the proceeds are devoted to the purchase of other manurial products is very doubtful, when the exigencies of the hand to mouth existence of the class who are concerned with them is considered.

MISCELLANEOUS NOTES.

THE whole value of the foreign corn trade in the United Kingdom, involving the movement of six millions of tons, may be computed at fifty millions sterling.

As many as 88,680 cwts. of indigo, from all countries, were imported into England in 1876, of the computed value of 2,129,986*l.* The bulk of this, however, was reshipped to the Continent, the average consumption of Great Britain ranging between 15,000 and 20,000 cwts.

WE hear that results regarding the collection of indigenous lac and the cultivation of rhea, in Assam, are not encouraging. Labour is yet excessively dear, which fact would in itself be a formidable obstacle to success, but the difficulties are multiplied by the utter lack of enterprise among the native Assamese.

A COMPANY called the Straits Sugar Company has been established, whose head-quarters will be Penang, with a capital of £30,000, with the object of cleansing and purifying sugar on the Weinrich process, the patent for which has been purchased by the Directors. Most of the capital has been subscribed in London.

THE Council-General of Guadaloupe have, it appears, offered a premium of 100,000 francs to the inventor of the best new process for extracting juice from the sugar-cane. The cost should not exceed 40 per cent. of the market value of the product. Experiments will continue until the end of June, 1880. Full information is to be obtained from the Director of the Interior, Guadeloupe.

WE mentioned last year that a Portuguese company was forming intending to grow opium in Mozambique. We hear now that the company has been floated, and has a capital of about 180,000*l.*, while its promoters have obtained from the Lisbon Government a concession of 50,000 acres of land, said to be well fitted for the culture of the poppy, at a trifling fee, and the right to export opium, free of customs' duty for a period of twelve years.

EXPERIMENTS have been made in France, which go far to prove that coir, or coconut fibre is well qualified to take rank among the paper-making materials known to commerce. Hitherto it has been used exclusively for the manufacture of coconut matting, the refuse being burnt. At the experimental trials referred to, which were conducted by the publishers of the *Journal des Fabricants de Papier*, 8 cwt. of fibre were converted into paper, and although the latter was not made on the machine, but in vats, the experimentalists do not hesitate to assert that the fibre may be employed for all kinds of white paper for which esparto is used; they even believe that a better paper may be produced from coir than from esparto. Further trials on a larger scale are projected.

ANOTHER new material for paper making, has been discovered in the cactus plant, which is indigenous in many parts of America, but especially in California and Arizona. Experiments have established its value: fine paper, it is said, having been made of it in the American mills. At Los Angeles, Cal., a mill for reducing it to proper shape for paper manufacture is established, and its success is considered beyond all doubt by the owners. If it be practically proved that good paper can be made of it, there is no end of the raw material. The whole Mohave desert, it is said, from Tehichipa to the Colorado River, probably about forty thousand square miles, contains large groves of cactus. It attains an average height of about fifteen feet, branching at the top, and will average about six inches in diameter. Its peculiar advantages as a paper producing plant, consist in the fact that the whole body of the tree is fibrous, and that after the earthy matter is removed every portion becomes paper pulp. Could we not dispose of our supplies of Prickly Pear in a similar way?

THE manufacture of cheap glassware in India, has long been regarded by us as an industry which has every chance of success; we have no lack of raw material, and can compete most favourably with imported glassware, the packing charges and freight of which in many cases, more than double the original value. All we want is sufficient enterprise and experienced labour. We are glad, therefore, to hear that a beginning is to be made, under the auspices of the Manager of the Murree Brewery Co. It seems that the difficulty of getting glass bottles at a reasonable cost in this country is increasing, and Mr. Whymper, was led to make investigations into the method of glass-making, practised by the natives of the Punjab. The chief home of the industry appears to be Sultanpore, in the Jhelum district, some ten miles up the river. There glass of the coarsest kind and shape is made in the clumsy manner which time and custom have hitherto sanctioned. Mr. Whymper obtained specimens of this glass, and of the raw materials from which it is made, and submitted them for analysis and report to Professor Keates, of London, an eminent authority on the subject. His opinion is very favourable to the prospect of the enterprise. "The materials," he writes, "might be used very well in the manufacture of beer bottles; and, with skilled treatment, in glass-making, generally. The alkali submitted is also suitable for soap making." Mr. Whymper is now carrying out at Jhelum, through the agency of a German glass-maker, a series of practical experiments in glass-making; and should the results be as favourable as is anticipated, it is proposed to establish at Jhelum a limited liability company for the manufacture and sale of glass in its most useful forms.

THE Russians, says the London Correspondent of the *Englishman*, have turned their attention to the manufacture of condensed horse-fodder after the manner of the Germans, and have now several establishments devoted to its production. By substituting a caked composite for oats, hay and such like ordinary horse-food, the cavalry are enabled to carry a goodly portion of their necessary supply. At the largest of these factories in St. Petersburg, five engines are constantly at work and can produce 1,000 cwts. of the amalgamated cake in the day. It is composed, in proportions, of oat and pease-meal, with linseed and a moderate proportion of salt. The amalgam comes forth from the ovens in the form of biscuits, which are perforated and strung upon an iron-wire on which they are packed tight, taking the shape of drums. Each of these weighs about four pounds, constituting a horse's daily ration. Every trooper can sling behind him provision for ten days food. The factory of Varneke produces 20,000 such rations per diem; it was the original one, and has already sent a million thereof to the army. Not only is the arrangement most valuable to the cavalry in the field, enabling them to move in districts where they otherwise could not do their share in military operations for want of fodder, but it gives desirable employment to women as well as men in the Russian capital at a time of pressure. We may profit by the experience when our mounted regiments are out next season, and prepare a similar supply against exigencies abroad.

COMMUNICATED ARTICLES, &c.

OUR AGRICULTURAL DEPARTMENT.

WE are glad to notice that the necessity of establishing a Department for the development of our agricultural resources, to which we have so repeatedly drawn the attention of Government, is beginning to be acknowledged likewise by our contemporaries. A very lucid article on the subject, appeared in a recent number of the *Madras Mail* which we republish below:—

"The Etcetera Department of the Supreme Government has covered itself with ridicule during the present year, and it is high time that it made way for something more useful. It should be divided; all the miscellaneous work being placed under the direction of one Secretary, whilst the land revenue and agriculture should be allotted to another. An attempt should be made to reproduce, even if only in a small degree, the best agricultural department in the world, that of the United States. The difference of circumstances, and the state of agriculture in this country would necessitate many modifications on the American mode but the same objects should be kept in view. Each Presidency should have its own department, under scientifically trained man. This officer who might be called "Commissioner of Agriculture," should have the direction of all the technical work of his subordinates, and be responsible to Government for the efficiency of his department. He should act as adviser on agricultural matters to Government; to him should be entrusted the collection and tabulation of all agricultural statistics; he should keep the Government acquainted with the latest discoveries of science which affect agriculture, and point out any variance from facts in the ideas propounded by the men of eminence regarding India and its agricultural improvement. He should be expected to travel about the country at all seasons. In every district two or more test farms or experimental stations should be established of about twenty or thirty acres in extent, each managed by a trained native or East Indian. These farms would be experimental in testing manures, processes and systems, and instrumental in showing to the ryot the advantages of improved agriculture. At each station meteorological registrations of the simplest kind could be conducted. As a beginning the Presidency should be divided into eight divisions under as many agriculturists in, as for example as follows :—

1st division	Ganjam Vizagpatam Godavery	2nd division	Kistna Nellore
3rd division	Bellary Kurnool Cuddapah	4th division	Chingleput
5th division	North Arcot Salem Coimbatore	6th division	Neilgherries Malabar S. Canara
7th division	Tanjore South Arcot Trichinopoly	8th division	Madura Tinnevelly

These divisions vary in area and importance but that would afford a means of promotion as they might be graded accordingly. The fourth division is the smallest one of the whole number but the Superintendent might be required to perform the important duties of Professor of Agriculture in the Agricultural College at Sydapet. The work of the Superintendents, besides the supervision of the test farms, would consist in affording advice to the collectors and other revenue officers; in observing the practices of the ryots of their divisions, and pointing out where they could be improved and in what direction the State should interfere with the freedom of action of its tenants, advising, encouraging, directing and enforcing the adoption of improvements for the benefit of the people; collating and preparing meteorological results, and market returns. The experiences and knowledge of this staff should be made use of in publishing such volumes as the United States Agricultural Department, and the Secretary for Agriculture, Victoria, annually give to the public. The monthly reports of the department might also be published, and by this means information would be distributed throughout the land. The Veterinary Department should form a branch of the Agricultural, and there should be an Inspector of cattle-diseases who might occupy the post of Professor of Veterinary Surgery at Sydapet. An Agricultural Department without a chemist would be an anomaly, and we would advocate the entertainment of a first class agricultural chemist for the investigation of questions regarding the soils, grains, &c., of this country. A naturalist should also form a part of the staff, and to him should be assigned the investigation of such questions as the acclimatization of exotic plants of value; the classification of our common plants to their typical soils; the habits and forms of the insect enemies of our crops, as well as the fungoid diseases from which they suffer. Besides their other duties, the chemist and the naturalist should be professors of chemistry and natural history respectively in the Agricultural College. The educational work of the Department should in the beginning be confined to the Sydapet Agricultural College and prizes and rewards should be offered something after the fashion of those given at South Kensington for science and art. The College with the staff of professors, we have mentioned, should be capable of producing men thoroughly fitted from their technical education to carry on the test farms that would be established. Whether or not it would be advisable to form, besides the veterinary and agricultural classes, one for forestry for the training of the subordinates for the Forest Department, is a matter that can be left for future consideration. If such a man as Low, or Card, or Lawes, could be found to set the department in proper order, no doubt amongst the men selected to aid him a fit successor might be found when his time was up. Such an appointment should not as a general rule be held for a long time, for progress would have to be the motto of the leader, and for the successful prosecution of the work a frequent change of blood would be desirable.

AGRICULTURAL EDUCATION FOR CIVIL SERVANTS.

IN connection with the appalling famine now devastating the Madras Presidency, the agricultural training for Indian administrators, which is discussed in the *Indian Jurist* of July 16, derives immediate interest, for there is reason to suppose that famine is only the natural result of ignorance and neglect. A short article appeared in a late number of the *Agricultural Gazette* on "India," in which the writer gave his opinion that "had his country (India) been managed under a good and rational system of culture, there would never have been more than very high prices—never would thrice the usual price of food have failed to purchase it." If this be the case, it is not to be wondered at that the *Indian Jurist* should give its opening pages and largest type, to the important subject of agricultural training for Indian officials.

A characteristic of the article in question is that, without dilating in general terms upon the present and prospective value of such training, it accepts that as already proved and enters, at once, upon the discussion as to the best manner of obtaining this special knowledge.

"Most of our readers," says the *Indian Jurist*, "are, no doubt aware that we have had in England for the last 30 years a College devoted to the study of scientific and practical agriculture. . . . An esteemed contributor has lately had an opportunity of seeing something of the system of instruction pursued, and it has occurred to him that it possesses some advantages as a place of residence for the selected candidates for the Indian Civil Service over either of our universities. . . . We do not, of course, mean to say that a university proper does not present many advantages which no mere college can offer, but we are pursuaded by the personal observations of our contributor that it has such strong claims to consideration as should not be overlooked."

The chief objections to the universities for the selected candidates is that "prolonged residence amongst men who are training for various professions in England, has a tendency to unsettle the minds of some men." Again, "except for its associations a university offers no advantages or facilities to the Indian student." On the other hand the Royal Agricultural College offers advantages which can (at present) be secured nowhere else; and with some modifications of the existing system (which would, we think, tend to improve its efficiency even as an agricultural college) it might be made a most convenient, as it would be a most healthy resort for young civilians." Our chief reason for pressing the claims of the Royal Agricultural College on the attention of the Indian authorities is of course because agriculture is fast becoming a subject of such vital importance in India that it seems almost as essential for our revenue officers to have some knowledge of it, as for our judges and magistrates to have some knowledge of law.

In reviewing the various subjects which a civilian should understand, the writer specially mentions law and languages, scientific agriculture, surveying, levelling, and, as of high interest, geology, botany veterinary science, agricultural chemistry, natural philosophy, and book-keeping. All these subjects, with the exception of the first two, are already taught at the Royal Agricultural College, and the modification required to fit the present curriculum to the wants of Indian officials need not be considered insurmountable. The article enlarges upon the healthiness of the situation of our Agricultural College. It also suggest that idle men should be dealt with summarily. "It should be the object of the authorities to raise the College above the rank of a mere school by encouraging the real students rather than to lower its character and diminish its influence for good by making it a receptacle for the 'ne'er do weels of our public schools."

From intimate and long-continued knowledge of the Institution we can assure the editor of the *Jurist* that he need be under no apprehension on this score. The authorities at Cirencester have long kept the object he contends for in view; and the amount of work done at Cirencester will compare favourably with that done in any other college in England

With reference to that mysterious factor in the selection of a place of education—tone. "If it should be urged that the tone of the Royal Agricultural College is not so high as that of our universities, and that the society is more mixed and not so improving, we say deliberately that there is not so much to choose even now between them and that with reasonable care in selection, and under earnest management, the tone of the College might easily be raised to the highest standard of our best public schools."

The writer of this article sees, then, in our Agricultural College an institution which, in its present form, is almost exactly what is required, as a place of residence and study for Indian civilians The changes he proposes are, as he himself confesses, very slight while some of them, as to age of students, penalties for idleness &c., have already been adopted to a considerable extent.

There are some points which we ourselves would suggest for rendering the college more effective, First, the remuneration and position of the professors should be improved. Many first rate young men have accepted the positions offered by the College, but almost invariably they have been induced to leave them after a very short service, As to the subjects taught, we have long felt that the subject of agriculture ought to be divided. It is too much to expect one professor to teach agriculture in all its aspects. To an Indian official a course of lectures upon irrigation would be essential. It would also be almost necessary to found a chair of rural economy for supplying lectures upon land tenure in various countries—the relations between landlords, tenants, and labourers, leases, tenant-rights, and kindred subjects. The agricultural professor would find abundant material in crop cultivation and stock management, without infringing upon the points last mentioned. Forestry would also require to be made a regular subject. With such changes the College at Cirencester might be made all that the Government would need for the training of its officials and instead of the 80 to 90 students at present frequenting its walls, we should expect to find double and triple that number. How to accommodate so large an accession of students might appear at first sight a difficulty. The *Indian Jurist* suggests that "greater facilities and conveniences should be offered to out-students."

This is no doubt required, and must be attended to if the College at Cirencester is destined to become the proud mother of enterprising Indian civilians. The *Indian Jurists* is hopeful. "We should not be surprised," it says in conclusion, "if in course of time men come to adopt the suggestion. They would be spending their time quite as usefully as in studying for the bar, and a great deal more beneficially as far as health is concerned, while to India and her agricultural classes the advantage can scarcely be over-estimated." *(British Agricultural Gazette.)*

CLIMATE AND RESOURCES OF UPPER INDIA.

Note by E. C. Buck, Esq., Director of Agriculture and Commerce, North-Western Provinces and Oudh.

I HAVE been desired by Government to write a note on the "Climate and Resources of Upper India," a work by Lieutenant-Colonel Corbett, of the Bengal Staff Corps, whose sudden decease, shortly after the publication of the volume, has unhappily deprived Government of the services of an officer whose devotion to agricultural subjects bade fair to produce valuable results. Colonel Corbett was not only a close observer, but was a practical experimentalist, and always provided facts before he made assertions. The consequence is that his book on the agricultural capabilities of these provinces is full of earnest and serious truths, which although they lie at our door, escape the observation of many whose gaze is directed at what they conceive to be higher objects.

Agricultural circumstances and conditions are the basis of the whole of our revenue and fiscal administration, and nothing therefore which affects the agricultural prosperity of the country ought to be considered too trivial for attention. The fact must be constantly borne in mind that a cause which produces a slight variation in the out-turn of one field can be made to produce similar variation in the out-turn of millions of fields, and although small in itself, yet it loses its insignificance when the immensity of the multiplier is taken into consideration. When Colonel Corbett proves that a wrong system of canal irrigation injures one acre of land, he proves that it injures the one or two millions of acres annually irrigated in these provinces. When he shows that the atmosphere of a garden can be affected by a special method of cultivation, he may be credited with showing that the climate of a whole province can be similarly affected.

The burden of Colonel Corbett's book on the climate and resources of Upper India is the praise of two things and the condemnation of other two. The objects of his eulogy are deep-ploughing and forest; those of his dislike are surface drainage and irrigation. He has nothing too good to say of the former, and very little too bad to say of the latter. But although Colonel Corbett's pictures are somewhat highly coloured and his assertions pushed to an extreme, yet there is always a substantial basis of truth in every argument which he brings forward.

He commences by insisting that the climate of the North Western Provinces has become drier and hotter of late years, and that this result is due—

(1) to decrease of forest area;

(2) to increase of irrigation.

The collection of proof, however, on such a broad question as the alteration of the climate of a country is a difficult matter, and it is doubtful whether Colonel Corbett has succeeded in substantiating by facts of statistical soundness his assertions that the heat of the North-Western Provinces has of late years increased. But no one will, I imagine, attempt to controvert his arguments that a well opened-up soil covered with vegetation, and both absorbtive and retentive of moisture, will maintain a cooler atmosphere than a hard, smooth, and denuded surface into which rain cannot penetrate, and which the scorching rays of the sun convert into a "heat-radiating fire-brick," or that while the former condition of land is vastly beneficial both to climate and agriculture, the latter is injurious to the health and well being, whether of animal or vegetable.

If we accept, as I do most thoroughly, these views, the question suggested by Colonel Corbett whether the increased use of *punkahs* or the heat of new barracks are due to novel agricultural conditions, or to the want of forest administration, rather than to more proximate causes, need not be discussed.

According to the author of the "Climate and Resources of Upper India," our agricultural system ought to aim at inducing "loose," or as it may be called an "opened land surface" with a cool temperate atmosphere, and at eradicating the opposite conditions of a tightly bound or "closed land surface" with a hot dry atmosphere,

This is a proposition which no agriculturist can refuse to accept.

The points then to which enquiry must be directed, in order to secure the desired objects, are the following:—

A (1).—What are the circumstances which are favourable to an "opened land surface" and cool atmosphere? and

(2).—How can their creation or maintenance be assisted?

B (1).—What are the circumstances which are favourable to the production of a "closed land surface" and hot dry atmosphere? and

(2).—How can they be eliminated or reduced?

The conditions (A) which according to Colonel Corbett's book are favourable to, and require encouragement for the production of an "opened land surface and cool atmosphere" are:—

(1)—an increase of forest and trees;

(2)—the addition of vegetable matter to the soil;

(3)—loosening and breaking up of soil by deep cultivation;

(4)—the retention and absorption of rainfall.

The conditions which are unfavourable (B) and call for repression are:—

(1)—denudation of land surface;

(2)—a hard surface layer or "pan;"

(3)—excessive irrigation;

(4)—surface-removal of rainfall.

How each of the first set of conditions can be encouraged and each of the second repressed will now be considered.

A I.—Increase of trees.

So much has been written to prove the beneficial effects upon climate of forest growth, and the evil results which occur upon its removal, that the question hardly allows of discussion. It may be admitted as an axiom that trees are a powerful engine in the production of coolness and moisture, and that their growth throughout a country afflicted with dryness and heat should be promoted. The reply will be made that we do encourage the preservation and increase of forests, and so far have done our duty. But is it so? No doubt we have been doing a great deal to maintain the woods of the sub-Himalayan regions, and to clothe our mountains with forests of new growth. But the question still remains whether belts of thick wood in the Terai or luxuriant forests on the ranges of the Himalayas will add moisture to the arid climate of Doab, or give rain to the famine stricken plains of Bundelkhand. The effect of an edging of verdure along the mountain boundary of the north upon the climate of the wide spreading plains of the south is probably so remote as to be inappreciable. A much greater, because a more proximate, influence will be exercised by the increase and encouragement of scattered groves, of lines or trees, and of small plantations throughout the agricultural area of the provinces, in which direction little has been done, except in the adoption of the negative measure of releasing grove lands from the payment of revenue, and by the occasional plantation by revenue officials of avenues of trees along public roads; steps have, however, lately been taken by Government to set on foot a more systematic administration of internal arboriculture.

Colonel Corbett gives a not inapt description of diffused arboriculture in the following words.—

> Supposing the country to be divided like a chess-board, the squares of, say, a mile each in measurement, the black squares planted with trees and bushes, and the white squares left bare for cultivation, the planted squares would absorb a great amount of the solar heat which fell on them, and the air in the day time above them would not be so hot as that coming in contact with the surface of the bare squares. The cooler air over the planted squares would by its greater gravity sink and displace the air over the bare squares as it became heated and expanded. At night the heat absorbed by the planted squares during the day would be given off by radiation, the superincumbent air would be chilled, sunk, and spread over the surface of the bare squares, displacing the more heated air which had not been chilled by radiation. The trees on the planted squares would act mechanically in checking and breaking the force of the wind, as a lattice-work breakwater breaks the force of the waves, they would also deflect the wind upwards; it would not sweep over the surface of the bare squares as it does over a plain where there is nothing to check its force, and its drying effects would be lessened. The surface soil of the bare squares would not be so dried and hardened from the action of the wind as the open plain now is, the air would contain more vapour of water evaporated from the trees of the planted squares, and this again would interpose a screen which would lessen the amount of solar heat falling on the surface of the bare squares. The soil of the bare squares not being so dried and hardened could be ploughed and broken up at any season of the year, which now it cannot be, owing to its hardened condition; and when broken up, it too would further help to moderate the heat of the hot weather by its increased absorptive and radiative powers.

The superstitious reverence of the Indian ryot for trees which his grandfather planted has hitherto saved grove upon grove, but when the price of wood rises, reverence for ancestry falls, and when railway companies offer cash for fuel, holy plantations sink before the more sacred rupee. The destruction of wood along the low hills of Bundelkhund for the supply of the Allahabad market proceeded of late years at so rapid a pace as to alarm the local authorities and to cause the Commissioner of Allahabad to bring the matter to the notice of Government; while at the other end of the province the Collector of Shahjahanpore urged measures to prevent the disappearance of wood for the supply of fuel to the new Oudh and Rohilkhund Railway. Colonel Corbett does not then raise a false alarm. Some system is necessary which will lead to the conservation and increase of plantations or trees, not only in ring fences like forest-covered tracts, but in scattered patches, wherever the nature of the ground permits trees to be planted without interfering with cultivation.

A 2.—Addition of vegetable matter.

The second requirement suggested by Colonel Corbett's pamphlet is the necessity of increasing vegetable matter in the soil :

> Another cause (he says in page 26) of the hardened condition of the soil, which affects, perhaps more than anything else the agricultural prosperity of the country, must not be overlooked, and that is the deficiency of vegetable matter in it. It is this want of vegetable matter which allows the soil to bind into a compact mass, prevents its aeration, and renders deep cultivation more difficult.
>
> This want of vegetable matter in the soil is caused by the stubble of the cereals and cold weather crops being eaten down as close as possible to the ground, the leaves of trees and stubble of the thicker stemmed crops, and the wooddy stems of cotton and other plants, being carried off and used as fuel, as also is all cattle dung, which is carefully collected and dried for that purpose, except during the rains ; and any small remains of vegetable matter there may be on the land are carried away by surface drainage.

But how do native cultivators act ? So far from collecting leaf manure from outside, they actually allow a horde of grain-parchers to descend like locusts upon their fields, and carry off every leaf blown down by the wind from the few trees and groves in the neighbourhood, What then can Government do ? It is impossible to place a police guard over fallen leaves and protect them from an invading army of grain-parchers ; yet it is possible so to increase the wood area, so as to provide enough fuel for roasting grain as well as for the supply of a substantial amount of vegetable food to land under cultivation. This is a very powerful argument for the protection and increase of our village woodlands.

Another argument for the increase of wood area in connection with fuel, which has often been brought forward and is alluded to on pages 26 and 27 of Colonel Corbett's book, is, that it will decrease the consumption of cow-dung which will then become available for manure. It is true, I know tracts where wood fuel does supersede cow-dung, and although, as Colonel Corbett pointed out, the ashes and non-volatile constituents of cow-dung supply valuable manure, yet the unburnt substance is of much greater value.

The first remarks made by the American farmer on being introduced to Indian cultivation struck me forcibly. "How can the people here," he said, "expect to keep heart in their land when they not only never put a scrap of vegetable matter into it, but actually scrape, pare off, and remove every morsal of vegetable matter which they find on it"

The question remains whether there is any other method of increasing the supply of vegetable manure. Colonel Corbett's book makes the same suggestion of "green manuring" (page 29) which occurred to the Virginian farmer when he saw the land in which he was required to grow tobacco.

It became my duty last year (1876) to prepare for the cultivation of this tobacco a portion of the stud lands at Ghazipore, and as I had been told by the Virginian curer that the best leaf would be raised on rotted vegetable manure, I set about procuring some I had hardly realized until then the alarming deficiency of vegetable manure. Luckily there was a heap of poppy refuse in the large opium factory at Ghazipore which gave us a fairly good supply for the small area which was to be planted with tobacco, otherwise I could not have supplied it, except at an excessive cost. There was no store on the fields, no store in the city, no stable sweepings, no dung-heaps, no pits of leaves, no straw, no hay, no jungle. But for the opium refuse, there was no vegetable manure to be had.

Every resident of India who has made, or tried to make, a garden in his compound knows the absolute necessity of hoarding a store of leaf manure, and I have been told by one (a lady, whose gardens are celebrated) that at the time when leaves fall, numbers of old women were employed by her to sweep up leaves for the purpose from the adjacent roads and plantations.

A 3.—Deeper cultivation.

The third and perhaps most important, method suggested by Colonel Corbett for "opening land surface" is deep-ploughing. Deep ploughing has long been quoted as a panacea for the exhaustion of Indian soil, a result which there is little doubt has been induced by over-cropping. "Bring up a new layer of soil from below, and behold a new India !" say the advocates for deep tilling, and there is some truth in what they say. But another, and no less weighty, reason for the encouragement of deeper cultivation of the soil is brought forward by Colonel Corbett. His proposition is this : deeply tilled soil holds water like a sponge. Therefore deep ploughing dispenses with irrigation and protects against drought. No proposition can be of greater importance to Northern India :—

> It is universally admitted by agriculturists in all countries, where farming has been studied as a science and is not despised and left in the hands of the most ignorant of the population as in India, that deep cultivation and pulverisation of the soil preserve moisture in it. The system of deep cultivation of the soil, and thus allowing the water to sink into it too deeply to be lost by evaporation, is that which, according to Marsh, was recommended by Palissy and Bobinet for the formation of artificial springs. In the case of deep cultivation generally over a country, more specially a level country, there is a reservoir of water under every field sufficient to supply the wants of vegetation held there by the soil itself.

The upper loosened soil acts as trees do, and shades the soil below it. The loosened soil acts as a sponge, "as the leaves of trees on the surface soil of a forest do, and arrests the rain falling on it, and gives it time to sink under cover ; and when the rain falling on the surface has sunk through the upper loosenned soil, it is as effectually protected from the evaporative influences of sun and wind, as is water in soil of a forest. The fact that leaves being on the ground prevent evaporation of moisture from it has led gardeners to employ leaves, straw, and other refuse vegetable matters, to spread on the surface to keep the ground moist by preventing evaporation.

How far the proposition is true, that deep-ploughing can dispense with irrigation in a season of drought, is partially illustrated by the history of the Allahabad Government Farm, where a system of deep ploughing has now been practised for some years, and in which the rent of land worked up by the English plough has been almost doubled and the effect in a year of drought, like that of the present year 1877, is most conspicuous.

There are therefore two vital reasons why the Government of India should spare no labour and expense in promoting a system of deeper cultivation. In the first place, the soil of a more or less exhausted country is renewed. In the second place, the necessity for irrigation in a climate where drought means famine is vastly decreased. So far we are at one with Colonel Corbett, who has done a service in bringing before Government in so clear a light the immense importance of the subject. But Colonel Corbett has not entered into the difficulties which have to be met inducing the agricultural population of the country to adopt the system which he has so rightly advocated, and they are not few.

These are at least the following :—

(1) Disinclination of cultivators to use a new implement.
(2) The inaptitude of English implements to agricultural conditions in India.
(3) Weakness of draught cattle.
(4) Expense of ploughs.
(5) Difficulty in keeping them in order.

Disinclination of cultivators.

These obstacles ought, if possible, to be surmounted, but much time and trouble must be expended in grappling with them before any success can be hoped for. The first difficulty, *viz.*, agricultural conservatism, is a dead weight only to be overcome by active attack. Sir John Strachey advocated the use of Court of Wards' Estates as a lever for removing the inertness of the agricultural masses in the following words :—

> Estates under the Court of Wards afford another means of promoting agricultural improvements. No one can be less inclined than I am to try doubtful experiments at other people's expense but I believe that, under proper superintendence, much might be done on these estates through the agency of the cultivator themselves. They might often be induced to try new seeds, new plants, or new methods of cultivation. The rapid increase of potato, opium and indigo cultivation in these provinces sufficiently proves that no real bar exists to the adoption of novelties by the agricultural classes when once they are convinced that they are remunerative.
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> The successful introduction of an improvement on one or two Court of Wards' Estates would have a much better chance of leavening the agriculture of the surrounding country then any number of equally successful experiments on the model farms. In fact, while the latter must be utilized chiefly in teaching experience to the Government, and in proving what experiments are likely to meet with success and what with failure, the latter should be employed in reproducing, for the education of the agricultural classes, any of those experiments in which success has been obtained. While leaving the general control over these Estates, as at present, in the hands of the district officers, much might be done in the direction of agricultural improvements through the agency of the special department.

"These Estates," it was said in the report on the administration of these provinces for 1871-72, "should be our model farms ; and the higher cultivation, the greater appearance of "comfort, the trim villages, and "the skilful utilization of natural advantages should testify to the people "what the effects of an enlightend management can be."

Inaptitude of English ploughs.

A first step has been made in the direction of introducing ploughs in Court of Wards' Estates, and will result, it may be hoped, in the acknowledgement by some native cultivators of their useful effects. A drawback, however, exists in the inaptitude of the English plough to Indian conditions, which is the second difficulty which we have to meet. It is difficult, for instance, to irrigate land ploughed on the English system, by which furrow scored hills are turned up in the same direction over each separate strip of a field. Another seemingly absurd, but perfectly valid, objection is that the driver of the plough cannot reach his bullocks' tails, bullocks' tails are the reins of the Indian ploughman, of which an occasional twist is the only preventive of a straggling furrow

Weakness of cattle.

The weakness of draught cattle is another great obstacle to the introduction of deep ploughing, and must operate to prevent the use of any but light ploughs. English ploughs of light draught are, however, used on some indigo estates with ordinary cattle, and it is possible that by commencing with slightly improved implements which the cattle of the present day can drag along, a corresponding improvement may, by a process of evolution, gradually be effected in the class of cattle used for ploughing. What Indian cattle want is more food, rather than better blood, and if the cultivator once finds that more food to cattle means still more produce from land, he may profit by the lesson. But how long must it take him to learn it ?

Cost of ploughs.

This is not, however, the end of our difficulties. The expense of ploughs is a greater obstacle than may at first sight be thought possible, An English plough can hardly be obtained for less than twenty rupees, and the cheapest country-made improved plough I have seen costs ten rupees, while both require constant renewal of shares. The outlay is very heavy for an Indian ryot. Although a judicious system of advances and economy in the construction of ploughs will probably overcome in time the difficulty of expense, yet much steady opposition must be expected on this score. The difficulty of keeping ploughs in order is yet another troublesome obstacle, but by no means the greatest, and one which must be overcome by as much simplicity as possible in the construction of new implements, and in providing a cheap and ample supply of those portions of ploughs which it is found that native *mistries* cannot construct.

Experiments are now being made on Court of Wards' Estates with the object of ascertaining the practical objections which Indian cultivators have to the use of English ploughs, and of obtaining their honest verdict as to their utility. Profits conquer prejudices, and perseverance must in the long run succeed in inducing natives to adopt ploughs if they prove profitable.

A. 4—Retention of rainfall.

The next proposition brought forward by Colonel Corbett, *viz*, the necessity of bringing soil into such a condition as to absorb and retain rainfall, is perhaps a corrollary of the other three, since the desired condition is induced by the vicinity of trees, by the admixture of vegetable matter with soil, and by deep cultivation. The immense importance of conserving rainfall in Northern India need not be discussed; it is patent to every one who has spent a summer north of Benares. But it is a self-evident object of which the importance reflects importance upon the questions hitherto kept in the back-ground, of promoting arboreal cultivation, vegetable manuring, and improved ploughing, which act in the direction of the conservation of rainfall, as well as upon those conditions of a converse character (enumerated previously under the head of B) which act in an opposite direction, viz.—

1. Denudation of surface.
2. A hard pan or upper layer of soil.
3. Excessive irrigation.
4. Surface drainage.

B. I—Denudation.

A growing tendency to denude land of trees has been noticed under the head of the conservancy of trees and forests, of which the effects on climate and soil are of course exactly the opposite to those of denudation. Measures ought to be, and I trust will be, taken to check the latter by increasing the former, and no more need be suggested new under this head. Then comes the "hard pan," another object of Colonel Corbett's objurgation, and which practically means an unbroken sub-soil. "The pan is formed by the treading of men and cattle. Its greatest density is immediately below the soil mechanically broken up in cultivation," and it is caused unwittingly, very much as the hard bed of a tank is wittingly produced by a puddling process under the feet of buffaloes. The pan must be broken, otherwise air and water cannot penetrate into soil. Where high farming in America and England is practised an open surface is preserved, and the pan eliminated by a system of sub-soil drainage, which has the effect of loosening the hardest strata, but in India such a process would be too expensive, as it could probably not be effected under fifty rupees an acre. Moreover, it seldom occurs in the Doab of these provinces that a sandy stratum does not lie very closely underneath a stratum of clay or loam, a circumstance which admits of natural sub-drainage, if the pan is sufficiently loosened to allow the passage of water through it. The remedy then lies in deep-ploughing and the softening of soil by increasing the amount of vegetable manure. Colonel Corbett describes the pernicious effect of the existence of a "pan" in combination with excessive irrigation, which combined are the object of his most energetic attack.

B. 2,—Hard "pan."

The two together convert, he says, the upper layer of soil into a firebrick. Let any one walk over canal-irrigated fields after the crop is removed in the month of May, and it will be hard for him to gainsay Colonel Corbett's assertions. Compare a well cultivated garden bed with an unmanured field lately subjected to a good canal soaking, and the results of the two opposite systems of agriculture will be apparent to the most uneducated eye.

The following extracts from Colonel Corbett's book explain his meaning :—

> The consequence of this (i.e., irrigating heavily a badly ploughed field) is, that when the soil has become heated by the sun during the day, it cannot part with its heat at night by radiation, as a loosened soil would ; the following day the rays of the sun fall on a still warm surface instead of a surface chilled by radiation, and less solar heat is required to raise its temperature, and eventually the temperature of the atmosphere, to a degree obnoxious both to animal and vegetable life.
>
> On other hand, when the soil is deeply broken up and well pulverized, the mess of soil so broken up loses at night, by radiation to the depth it has been broken up and pulverized, the heat it acquired by absorption the previous day ; the rays of the sun fall in the morning on a surface chilled by radiation.

I am completely at one with Colonel Corbet as to the evil effects of irrigating ordinary unmanured soil. There is no subject on which I have written more strongly for many years past, and no effect which has been more urgently impressed upon my notice by the cultivating population.

B. 3.—Excessive irrigation.

Colonel Corbett's language is strong indeed. "Canals and irrigation are," he says, "doing more than anything else to destroy the agricultural prosperity of the country, and to reduce land formerly fruitful to a state of sterlity." But perhaps strong language and strong examples are required to rouse attention. It is certain that years have passed during which canal waters has been undermining the fertility of soil which it has irrigated without any notice having been taken of the process, until suddenly our revenue administrators have been startled to find that in certain tracts of canal-irrigated land, rents cannot be paid and crops have ceased to grow.

Colonel Corbett quotes the following extract from the letter of an indigo planter which is worth repeating :—

> The produce in canal-irrigated lands, in my opinion, will be worse yearly ; what with sowing the same seed, and with this constant cropping and flooding, the lands are being thoroughly exhausted. I remark yearly a great falling off of leaf, and this, by-the-bye, appears to be increasing. Canal plant grows too quickly ; it is, in fact, forced, and it consequently cannot draw sufficient support from the soil fast enough to keep pace with its rapid growth. If I am right in my conjecture, produce will get worse as the soil becomes more exhausted, &c.

There is no doubt whatever that too much attention has been given to extension of canal area, and too little to the conditions under which it is extended. Nothing is so valuable as water in a dry climate, when properly applied. Nothing hurts land more when injudiciously used. Besides hardening the surface of land, water robs it of plant food in two ways. In the first place, it is the mechanical agent by which a crop takes up the fertilizing elements of soil in solution, which are removed with the crop at harvest ; and in the second, it carries away plant food in solution, as it percolates to the drainage water-level. Only so much water, therefore, should be given to land as will be required by the crop growing on it, and then only so much as will allow the fertilizing elements which it removes to be replaced by manure. If restrictions are not exercised, canal-irrigated country will be unable to provide a large food-supply in a famine year, rents will fall, distress will abound (as it does *now* in many canal-irrigated tracts) and canal water will acquire an ill-deserved reputation. On the other hand, apply canal water in proper quantities to land which can afford to take it, and the canal country of North India will become a garden, for population and manure will then increase, and with them irrigation and plentiful crops.

The best and most effectual method of restricting canal water within proper limits is not to sell it too cheap ; sell it in fact at its full price which in many cases is double and more than double what it is now sold for.

The following cautions on the subject of irrigation are addressed by a well-known English gardening authority (Mr. Fish) to students of floriculture, and if such caution are required for the instruction of English florists in a country where irrigation is comparatively little practised, how much more should similar restrictions be enjoined on Indian cultivators, to whom we have suddenly made a present of a cheap and unstinted water-supply, to the use of which they had not been accustomed, and the effect of which they could not know. Many a native cultivator or landlord has said to the writer :—"When the canal first came into our village we thought our fortunes were made ; for two or three years the village was a garden but year after year we have seen the "crops grow shorter and the ears became lighter, until now our out-turn is far less than when we had no canal at all" :—

> The mode of watering, though simple, also constitutes an element of success. The general mode is to plant the bed or border, and then water all the plants from the surface. The consequences are that in very hot days the moisture is soon evaporated, the soil is cooled in consequence, and in clear nights that extra cooling is greatly promoted. When the plant shows distress *the process is repeated and by-and-bye the surface of the bed* becomes pretty well as impervious to air as an iron pan, *and the operator shakes his head and wonders why with all his waterings, the plants will not grow.* Though far from believing our mode to be anything superior, I humbly submit it to notice, confident that many amateurs by adopting it may save much watering, and also be gratified with more success. As soon as the plants of a ring or two in a circle or part of a row in a bed are put in their places by means of a trowel, and are well fastened there by the hand, but so that the earth removed is not all returned, but a basin of from 1 to 2 inches from the surface of the border is left, the plants receive just as much water as will thoroughly moisten all their fibres and the earth around them, so as to furnish moisture enough for absorption for some time. The plants, if to be kept up, are then secured in their places by sticks or twigs, &c., and by that time all the moisture having been absorbed, the dryish earth is put over the basin and left in rather an *open* comfortable condition. So the work goes on ; the moisture surrounding the roots, the dryish soil covering the two, which both prevents the moisture freely escaping, and the soil about the roots getting greatly more cooled than when the plants were turned out. Of course in very sunny days we expect some of the leaves of the plants to flag ; but knowing there is enough of moisture at the roots, we attribute the flagging to the leaves at first perspiring more than the roots in their new position are able to absorb, and, therefore, to help them, we do not deluge the roots, which are wet enough already, but we either shade the plants or sprinkle them repeatedly with a syringe or a garden engine to lessen evaporation from the foliage. When in dry weather in June and July, the plants actually want watering, we give it in moderation at the roots from the surface, and as after that time the soil is hot enough for anything, we *stir* the surface of the ground as soon as it is dry enough, and either work with a fork or Dutch hoe, to prevent the mass of the soil getting much warmer, and to prevent the moisture escaping into the common atmosphere, instead of constituting a store round the roots. When visited with refreshing rains their benefit is rendered more lasting by similar surface stirrings, until the beds become so covered with flowers and foliage as to take care of themselves.
>
> We have noticed repeated heavy waterings given in June, when less than a tithe of the quantity of liquid sprinkled on the foliage would have been attended with more beneficial results. Few of our favourite bedding plants delight in the marsh or the quagmire, and yet the culture often given would lead to the idea that water and watering were the only indispensables for their successful culture. Something will be gained if the impression gains ground, that, provided the roots are placed within reach of a sufficiency of moisture, every quartern, gill, or pint given above that sufficiency, and especially in the first four or six weeks, after planting, will be attended with unfavourable *rather than favourable results.*

One more point remains to be noticed, and that is the complaint by Colonel Corbett of the growing tendency to remove rather than to conserve rainfall. The question whether it is right to assist or to obstruct natural drainage must, however, depend upon the physical conditions of each tract. As a general rule, where water is near the surface, drainage is right, where it is distant, drainage is wrong. Very great assistance may certainly be afforded to agriculture, both in the way of improving climate and of increasing facility for irrigation, by hoarding the natural drainage of the country in suitable localities. The formation of lakes in Bundelkhund is an instance on a large scale (which, however, can only be imitated in hilly tracts) of what can be done by the conservation of drainage, but a vast deal of water may also be stored even in the plains of India wherever there is any slope in the land surface. A notable example occurs in Captain Chapman's estate in the district of Partubgarh, where the drainage of several square miles has been caught and stored up in reservoirs, with the effect of doubling the value of the land which it irrigates. A similar plan was adopted by myself with success at the Government farm at Ghazipur, where the drainage of about four miles was intercepted and utilized for irrigation. My experience confirms therefore the truth of Colonel Corbett's idea that the agricultural capacities of the country may be enormously increased by manipulating surface drainage.

B. 4.—Surface drainage.

I will not discuss that portion of Colonel Corbett's note which deals with reh. The Government of the North-West have lately directed a full and practical investigation into the subject, and the result of the enquiries which Sir George Couper has set on foot may be awaited. It is sufficient to place on record the fact that Government quite as fully recognized in reh an enemy to agriculture as did Colonel Corbett.

Reh.

Colonel Corbett has been loud in his complaints, but has not cried out without cause, or without careful investigation and experiment, which deserve the gratitude of Government. He has supplied better tests of the value (or the opposite) of irrigation than any of our model farms, and has certainly proved the great efficacy of deep cultivation without water, a fact which cannot be brought too often or too strongly before the notice of Government.

I know that Government, if assured that capital can be as remunoratively laid out in an improved system of cultivation, as in canal construction, will not hesitate to grant it for the purpose, especially if the results is protection against famine and drought. Colonel Corbett complains that :—

> Had a fraction of the amount expended on irrigational works been spent on improving the agriculture of the country, there would not now have been the increased demand for further engineering works to supply water. But no attempt is made, not a rupee is spent, in improving the agriculture of the country, and it is carried on in the old antiquated way.

But it would be wrong for Government to spend a rupee until it is assured that the rupee is rightly spent, and such an assurance is now being sought by practical experiments in the very directions which Colonel Corbett has pointed out. Colonel Corbett, for instance, has done much to prove that deep ploughing is an improvement on the "antiquated method." Our model farms have proved it too, and we are now trying what our cultivators on Court of Wards' Estates think of it. The native's verdict will be surest. As soon as the feasibility and advantage of the new system become assured, it will become as much the duty of Government to buy ploughs as to construct canals.

I have in the above note followed only the broad lines of Colonel Corbett's arguments, with which in their general outline I fully agree. Even where the arguments are, as occasionally happens, pushed to an extreme, I sympathise with the ardour and good intention with which they are brought forward. But Colonel Corbett however, to clear his perception of the paths which should be followed, and the goals which should be gained, did not perhaps sufficiently appreciate the difficulty of constructing the road. Take the example of deep cultivation which I have noticed. It is no easy matter to persude a native to use an English plough, even if it is presented to him. That little difficulty about twisting the bullock's tails is enough to "put him of" and so with every change in agricultural methods. Small circumstances crop up and create friction in practice, which in theory are invisible or unappreciated. Still Colonel Corbett has bequeathed a legacy to Government which will, if the matters it contains are treated with serious consideration, prove of lasting value, and will earn a fruitful reward to the years of labour which the author of this book bestowed upon the subject on which he wrote.

SUCCESSFUL CULTIVATION OF RAGI.

ON THE BANGALORE EXPERIMENTAL FARM DURING THE YEAR 1877.

A SEASON OF DROUGHT.

In compliance with the suggestion of the Chief Commissioner in his Review of the Annual Report of the Experimental Farm for 1876—77, that monthly or periodical statements of the experiments in progress, and the results attained, should be furnished for publication in the *Mysore Gazette,* I have the honor to forward the following.

The main object of the ragi experiments undertaken on the farm this year, was to afford comparative results between continued deep cultivation incident on the use of iron ploughs, and that ordinarily pursued.

Deep versus shallow cultivation of ragi.

The land selected for this experiment consisted of the following plots.

Plot No. 1.—Had been cultivated with English ploughs since October 1875, and had consequently experienced the benefit of a year and a half's cultivation, and of lying ploughed up during two hot seasons. It had received a dressing of twelve loads of village manure per acre in December 1876 after bearing a crop of kusumba. In character the land is a medium loam, which previous to the opening of the farm had become overgrown with buffalo grass and other tenaciously rooting weeds.

Had it not been for the use of an English plough it would have been impossible to eradicate these roots without hand picking and burning, but through the action of this implement inverting the furrow, the roots were exposed to the drying influence of the sun and air, while the leaves being buried, decayed. As a consequence of thus killing the weeds in the ground, the whole of the organic matter was retained in the soil and aided very materially the absorbtion of moisture from the air, and its retention during the scanty rainfall of the south-west monsoon; besides assisting by its chemical action, the increase of available plant food previously lying inert in the soil.

Plot No. II.—This plot had only experienced the benefit of one summer fallow and one year's cultivation, being broken up in May 1876, when it was sown with peas and oats. Both of these crops failing were eaten off by cattle, so that their action was insignificant.

In December 1876 it received a dressing of twelve loads of village manure per acre.

Plot No. III.—This plot formed a portion of the land transferred to the farm in March 1877. It had previously been cultivated by the former owner precisely in the method usually adopted by the ryots of the district, and being in close proximity to the town had experienced the same advantages as the rest of the farm land in receiving manure. It was dressed with twelve loads of village manure as soon as it passed under my superintendence. Cultivation commenced on this land on April 1st by ploughing with an English plough after the heavy rain of 2·2 inches that fell on that occasion. It must be noted that this land not being overgrown with weeds received no addition to its value by the ploughing in of organic matter.

Plot No. IV.—This plot was a continuation of plot No. III and was dressed with twelve loads of village manure, but cultivated only with the native plough. The following is a tabulated statement of the experiment.

FINANCIAL RESULTS.

In this the cultivation from the harvesting of the previous crop is reckoned. The price of seed is that at which it was severally bought and sold.

Plot No. I.

Dr. *Cr.*

To—	Rs.	As.	P.	By—	Rs.	A.	P.
1,340 measures ragi, at 10 per rupee ...	131	0	0	*2 Ploughings before hot weather with English plough ...	8	0	0
7,840 lbs. straw, at 300 per rupee ..	26	2	1	2 Ploughings before sowing ...	2	0	0
				2 Harrowings ...	0	8	0
				1 Drilling ...	0	6	0
				† Seed, five measures	1	0	0
				Weeding ...	4	0	0
				‡ Harvesting ...	10	0	0
				Watching ...	1	0	0
				§ Manure ⅔rds of 12 loads town refuse at 0—4—6 per load	2	4	0
				Rent	2	8	0
				Balance ...	133	8	0
	160	2	1		160	2	1
Profit	133	8	1				

Plot No. II.

Dr. *Cr.*

To—	Rs.	A.	P.	By	Rs.	A.	P.
730 measures ragi, at 10 per rupee ...	73	0	0	*2 Ploughings before hot weather with English plough ...	8	0	0
3,810 lbs. straw ...	12	0	0	2 Ploughings before sowing... ...	2	0	0
				2 Harrowings ...	0	8	0
				1 Drilling ...	0	6	0
				† Seed, five measures	1	0	0
				Weeding ...	4	0	0
				‡ Harvesting ...	5	0	0
				Waching ...	1	0	0
				§ Manure ⅔rds of 12 loads town refuse at 0—4—6 per load	2	4	0
				Rent	2	8	0
				Balance ...	63	6	0
	85	0	0		85	0	0
Profit ...	63	6	0				

* This ploughing being hard, less is done in the day at this season, consequently the cost is greater.

† The land being good and in excellent order and the sowing time early, the seed was drilled in rows one foot apart by the English drill.

‡ As the years ripened irregularly through the effect of the dry season, they had to be cut from the straw by women on three successive occasions and were thrashed by hand in order to prevent loss by theft and to secure an early sale.

§ ⅔rds of value only is charged as the manure of some value to the succeeding crop. Carting is not charged as the cattle would, but for this work, be idle.

Plot No. III.

Dr. *Cr.*

To—	Rs.	As.	P.	By—	Rs.	As.	P.
300 measures ragi, at 10 per rupee ...	30	0	0	2 Ploughings before sowing ...	2	0	0
1,310 lbs. straw, at 300 lbs. per rupee...	4	5	10	Harrowings ..	0	8	0
				Drilling ..	0	4	0
				*Seed 10 measures ...	2	0	0
				Weeding ...	6	0	0
				Harvesting	2	8	0
				Watching	1	0	0
				Manure ⅔rds. of 12 loads town refuse at 0-4-6 per load	2	4	0
				Rent ..	2	8	0
				Balance ..	15	5	10
	34	5	10		31	5	10
Profit	15	5	10				

* This plot was drilled with native drill 4inches apart.

Plot No. IV.

Dr.				*Cr.*			
To—				By—	Rs.	As.	P.
‡ Ragi, None Straw, „				*3 Ploughings with native plough=6-12-0 ...	3	6	0
				3 Harrowings	0	12	0
				Drilling (three times)	0	12	0
				Seed for three times, 30 measures at 5 per rupee ...	6	0	0
				Weeding ...	...	...	...
				Harvesting ..	...	...	...
				Watching ..	...	...	...
				†Manure 12 loads ...	...	...	...
				‡Rent ...	1	4	0
					12	2	0
				Loss ...	12	2	0

* Presuming a plough and a pair of cattle to be worth As. 12 per diem (the price at the time they were employed,) and three sets required to plough an acre. As this cultivation is useful to the succeeding gram crop only one half the expense is debited to the ragi.

† As there was no crop, this is not charged for.

‡ One half rent is charged, the remainder being debitable to the succeeding gram crop.

This statement seems so startling at a time when the effects of famine are felt throughout the Province, that it requires further explanation. First, with regard to the sowing time. The plots were sown on May 26th or 27th after a rainfall of 2·04 inches since the 17th of that month which rendered the land sufficiently moist for planting.

The depth of loose soil was as follows :—

Plot No.	I	...	8 inches.
Do. „	II	...	7 „
Do. „	III	...	5 „
Do. „	IV	...	3½ „

The rainfall from April 2nd to May 17th had been ·23 of an inch, consequently the subsoil retained no moisture from previous falls of rain.

The grain in all the plots germinated freely, and no difference in appearance could be detected for some time as the weather continued showery, and 2·89 inches of rain fell between the date of sowing and June 14th. From that date until July 3rd, only ·28 inch was recorded, and as a result the moisture in the 3½ inches of loose soil in plot No. IV evaporated to an extent sufficient to cause the complete destruction of the young crop. In plot No III the plants languished, but still retained sufficient vitality to exist.

Plots I and II continued healthy.

On July 6th after ·33 inches of rain plot No. IV was re-sown, as like many of the ryots in the neighbourhood. I was led to sow by the sky presenting every appearance of more rain. Appearances were however delusive, and the crop but germinated to die from the continued drought which lasted throughout the month At the commencement of August all the plots urgently required rain, the stems being stout and stunted and the leaves brown at the tip. On the August 6th ·63 inches of rain fell, and a third sowing was made by myself and my neighbours, but a week's drought again rendered the operation but a waste of seed. The land was then left untouched until September when gram was sown, it being the general opinion that to sow ragi so late in the season was hopeless. A little was however sown by some neighbouring ryots which owing to the unusually late season produced a quarter crop of poor grain and two-thirds of a crop of straw.

The rain in August caused the ragi in the surviving plots to put forth a few ears, which were supplemented by a larger number through the rain in September. Harvesting was commenced on October 1st, and the ears being thrashed out by hand, some of the grain was sold as early as October 12th, and a large quantity disposed of before the end of the month, at ten measures per rupee.

This is a point of much interest as shewing that had deep cultivation for ragi been the rule instead of the exception, the staple grain of the country might have been available in quantity at this early date to arrest import and save money from flowing out of the country ; while the advantage of growing 2,813lbs. per acre at a time when the whole country is suffering from drought and famine through the adoption of deep cultivation is too obvious to need comment, more especially when, even in favorable season, the average returns by shallow cultivation is only 512lbs. per acre throughout the Province. The saving of labor by using English ploughs, which plough so much more land in a given time, is allowed for in the calculations ; and through the heavy loss of plough-cattle throughout the province during the recent unfavorable years, is a point demanding attention, if the land under cultivation is to retain its present area.

The saving in seed at a time when its price was so great is also noteworthy. From plot N. I a plant plucked casually was examined. It was found to contain 24 ears and among these an average ear of seven parts was filled with 2,056 fully matured seeds which is equivalent to a return of 49,442 fold.

In conclusion, I may state that the cultivation of other crops by means of deep cultivation is equally striking. Kambu, cotton, potatoes gram, cholum and maize have been seen by numerous visitors to the farm in various stages of growth, and the unanimous verdict is that they are severally the finest that have ever been seen by the examiners.

F. E. HARMAN, M. R. A. C., F. C. S.,
Supt. of Experimental Farm,

14th November 1877.

RATIONAL FARMING.

MR. MacIvor delivered lately a lecture on the above subject in the Mechanics' Institute, Romsey. There was a fair attendance of agriculturists present, and the lecturer's remarks were patiently listened to throughout, and at the conclusion a unanimous vote of thanks was accorded to Mr. MacIvor for his delivery. The following is a full report of the lecture :

It is desirable that we should at the outset answer the question—what is rational agriculture ? It consists in raising from a given area of land the largest amount of vegetable and animal produce with the minimum expenditure of capital and labour, and with the least possible exhaustion of the soil. In order that he may accomplish this the farmer must combine practice with science. The colonial agriculturist has not as yet paid very much attention to the teachings of science. The system of practice pursued must, therefore, have been of an eminently exhaustive character. Having impoverished one farm by growing a succession of cereal crops, the farmer moved to another farm, where the old ruinous system was again carried on, and in course of time he, in many instances, moved to a third farm, which suffered the same treatment as the others. The days of this kind of farming are numbered. The area of agricultural land open for selection is being rapidly taken up, and many farmers have made up their minds to remain where they are rather than drag their families over the length and breadth of the country in search of new homes. This being the case, there is a well-founded hope that the days of rational farming is not far distant. Weary of groping in the dark, the farmer begins to call for the light of science to guide him. Let us then, whilst sighing over the past, look forward hopefully to the future. We will now proceed to explain as clearly as possible the general scientific principles of good farming. Let us begin with a few brief remarks about the composition of farm plants. Well, then, they all contain water—indeed, this is the most abundant constituent of root and fresh green fodder crops. Turnips contain from 90 to 91 per cent. ; mangels and sugar beets about 88 ; carrots, 86 ; parsnips, 85 ; onions, 88 ; potatoes, 75 ; clover, 80 to 83 ; young grass, 80 ; grasses generally 70 ; and lucerne, about 75. In the cases of grasses and straw crop especially, the proportion of water present diminishes as the plants approach maturity. Thus for example, Buschmidŏr found the oat plant to contain during four successive changes of growth the following per cents. of water :—1.—58 days after sowing, 80 ; 2, the ear just left its sheath, 73½ ; 3, full bloom, 63½ ; and 4, ripe, 35-1/5. What has been said about oats applies, *mutatis mutandis*, to other straw crops. When we expose a dried plant to the joint influence of heat and air, we find the greater part of its substance to burn away, leaving a small quantity of mineral matter (ash) behind. The combustible part consists of four kinds of matter, or, as they are termed "elements," carbon (the combustible matter of charcoal coal), hydrogen, oxygen and nitrogen (the active principle of ammonia and the manure known as nitrate of soda). The relative proportions of these elements present in every 1,000 parts of dried produce can be seen from the diagram :—

—	Grain of Wheat.	Straw of Wheat.	Peas.	Potatoes.	Hay of Clover.
Carbon	461	489	465	440	4,754
Hydrogen	58	53	62	58	50
Oxygen	438	381	400	417	378
Nitrogen	23	4	42	15	21
Ash	21	70	31	40	77
Total	1,000	1,000	1,000	1,000	1,000

The sources of the different constituents of plants are given on diagram No. II. Carbon derived from the atmosphere, hydrogen and oxygen from water, nitrogen derived mainly from the soil, and ash entirely from the soil. The ash of plants consists of at least nine substances. Potash, soda, lime, magnesia, red oxide of iron, phosphoric acid, sulphuric acid, silica, chlorine (mainly as common salt). Most of these substances are familiar to farmers, so I need not take up your time with a description of each of them. It may, however, be remarked that potash is the main constituent of wood ashes. According to my distinguished friend, Baron von Müller, the ash of *Eucalyptus* wood is particularly rich in potash. Red oxide of iron is nothing more or less than iron " rust ;" it is the red colouring matter of the soil. Silica is a form of sand soluble in water—it is the stiffening material of straw. In order that a farm plant may reach a healthful and early maturity, it is absolutely necessary that an abundant supply of all the matters required to build up its substance should be within easy reach of its roots. If any one of these are deficient the plant cannot grow. Thus, for example, if we sow wheat seed in a soil containing everything required to bring the plants to maturity with the exception of, say, potash, we will look in vain for a crop until this deficient substance is added to the land. It is of importance that you should remember that the presence of an inadequate supply of any one of the constituents of plant food is, in most instances, as fatal to a crop as if all were deficient. Having become acquainted with the sources of plant food, we are prepared to enter upon the subject of land exhaustion. A soil of average fertility may be said to contain about a half per cent. of plant food, the remaining 99½ being composed of matters which, although serving indispensable purposes, in no way contribute towards building up plants. Admitting this to be the case, you can readily understand that the constant removal of produce from unmanured land must sooner or later result in the exhaustion of the soil. It must be borne in mind that the exhaustion is not generally due to the removal of all the constituents on plant-food, but to the complete abstraction of one or two of them only. Before going further I had better show you to what extent crops exhaust land. An oat crop of 45 bushels of grain (at 42lbs. per bushel), and 1½ tons of straw will remove in pounds per acre the following quantities of plant-food :—

—	Grain.	Straw.	Total Crop.
Nitrogen	37·8	14·2	52·0
Potash	8·5	29·6	38·1
Soda	1·1	5·9	7·3
Lime	2·0	9·8	11·8
Magnesia	3 9	5·3	5·2
Red oxide of iron	·4	2·1	2·5
Phosphoric acid	11·8	7·1	18·9
Sulphuric acid	·8	4.8	5·6
Chlorine	—	5 5	5·5
Silicate	24·8	69 3	94·1
Total	92·1	153·9	246·0

So that an average crop of oats removes from an acre of land 2cwts. and 22lbs of plant food. The straw of cereals, and also that of beans and peas, impoverishes the soil to a much greater extent than does the grain. The amount of plant food removed from land by root crops is also very large. An average crop of wheat or barley will not contain much more than 50lbs. of nitrogen in grain and straw, nor more than 190lbs. of ash constituents, of which 30lbs. will be potash and 19lbs. phosphoric acid. Root crops, when sold off the land, are more exhaustive than corn crops. A crop of 22 tons of mangels, and about 8 tons of tops, will remove in pounds per acre the following quantity of plant food :—

—	Roots.	Tops.	Total Crop.
Nitrogen	96·0	51·0	147·
Potash	191·1	71·4	262 5
Soda	75·4	65·2	140·6
Lime	24·2	29·1	53 3
Magnesia	19·7	27·2	46 9
Phosphoric acid	34·0	15·1	49 1
Sulphuric acid	15·2	20 2	35·4
Chlorine	40·6	49·8	90·4
Silica	16·4	9·2	25 6
Total	512 6	338·2	860·8

Here is a case of land exhaustion ! An acre of good mangel land, yielding a crop amounting to 22 tons of roots and 8 tons of tops, is impoverished to the extent of 7 cwt. and 67lbs. of plant food. Sugar beet and carrots are also very exhaustive in their influence on the soil. Roots take much more potash from land than any other kind of crop. Thus, 10 tons of potato tubers and the accompanying tops contain 1½ cwt. of this substance. It was formerly believed that broad-leaved root plants obtained the greater part of their nitrogen from the atmosphere, but Lawes and Gilbert have shown that such is not the case. According to their more recent researches turnips get their supplies of the element from the soil. Hay crops are most exhaustive upon the soil. Taking the average crop of clover hay at 2 tons per acre, the plant food removed will be in pounds per acre:—

Nitrogen	101 6
Potash	87·6
Lime	86·1
Magnesia	30·9
Phosporic acid	25 1
Sulphuric acid	7·6
Chlorine	9·4
Silica	6·8
Total ...	355·1

Two tons of clover hay exhaust the land to the extent of about 3cwt. and 19lbs. of plant food. It is a generally received opinion that cattle especially sheepfeeding does not impoverish the soil—indeed, many, intelligent farmers go so far as to say that sheep return more plant food to the soil than was present in their feed. That this is an erroneous belief becomes apparent when we remember that the mineral part of the bones, the salts of the blood, the potash in the "yolk" of wool, the sulphur in the wool itself, and the ash of milk are all derived from the soil. In the case of store cattle, the quantity of plant food removed from the pastures is very small, but growing cattle, milch cows and sheep, whether young or old, impoverish the soil to a considerable extent. The following diagram, compiled from the results of Drs. Lawes and Gilbert, will give some idea of the quantities of some of the constitutents of plant food removed in animal produce:—

—	Nitrogen	Phosphoric Acid.	Potash.	Lime.
Fat ox : 1,000lbs. fatted	lb.	lb.	lb.	lb
live weight ...	23·18	16·52	1·84	19·2
Do. sheep : 1,000lbs. do.	19·60	11·29	1·59	12·8
Do. pig : 1,000lbs. do.	17 57	6·92	1·48	6·7
Milk : 100 gals. ...	5·25	2·03	1·80	1·6
Wool : 1,000lbs.	78·09	1·00	40·0	1·

As can be seen from the diagram, wool-growing impoverishes the soil of potash. It may also be mentioned that 1,000lbs. of washed wool contains about 15lbs. of sulphur, which is also derived from the soil. Having discussed the causes of land exhaustion, let us proceed to the explanation of the means of restoring the fertility of worn-out land, and also of the scientific principles which must be observed by the farmer if it be his desire to prevent the exhaustion of his farm. Having impoverished his land, or part of it, to such an extent that it refuses to yield a remunerative crop, the farmer asks himself the question, "What is the cheapest means of restoring the productiveness of my soil?" In many cases he comes to the conclusion that fallowing, will suit his purpose best. In a former lecture I explained the chemistry of fallowing, and showed that the practice of growing crops until the the land began to fail, and then bare fallowing, with the view of restoring fertility, was a most exhaustive one. Fallowing should only be adopted for improving heavy clay land, and for cleaning foul soils. Green manuring is another means of increasing the productiveness of some soils ; but its beneficial influences are not of such a nature as to return to the land the substances which have been removed in preceding crops. Manuring is the only means of truly restoring to the soil the constituents of plant food which have been removed. The best manure we have is farmyard "dung," it should, therefore, be carefully preserved, for when left to climatic influences it deteriorates in quality. It should be applied to roots and pasture land, as it contains much potash, the principle ash constituent of roots and grasses. When well prepared it is the best potato manure. It should not be used for growing cereals, as the probability is that there would be a rush of straw and but little grain, Peruvian guano ranks next in value to farmyard manure. It contains but little potash, but is rich in phosphates and ammonia, substances of great importance to cereals especially. It is not a potato manure, but may in some cases give a fair return. When applied to cereals at the rate of about 3cwt. per acre, it gives a highly remunerative result, but when used for a series of years on the same land it will cause the exhaustion of the potash of the soil. By manuring land with dung for roots, and then with Peruvian guano (reduced in strength by admixture with Lacepede Island guano or superphosphate of lime) for wheat or other cereal crop, the farmer can prevent land exhaustion. In the absence of "dung," a judicious mixture of fertilisers, such as Peruvian guano, superphosphate of lime, and salts of potash and magnesia, would accomplish the same end. The question now comes. "How is the farmer to get the potash and magnesia?" I find that these compounds, or, at any rate, the potash, can be imported from Germany and sold in Victoria at a much lower price than I could have expected. Messrs. Anderson and Drake, of Melbourne, purpose importing a large quantity of cheap potash, and, I hope, for their own sakes, that the farmers will give these gentlemen every encouragement. It is at my suggestion that they have undertaken the experiment, and I should not like to see them lose by it. Bones in the form of "dust" constitute an excellent and lasting manure for roots and diary pastures. Superphosphate of lime is a manure which has not received much attention from colonial farmers. It is applied with great advantage to roots, being much more soluble than bone "dust." When mixed with ammonia salts or nitrate of soda and applied as a top-dressing to wheat, oats, or barley, it yields excellent results. I may mention that Messrs. Grice, Sumner, and Co., of Melbourne are now manufacturing a very excellent superphosphate of lime from Maldon Island guano. The same firm have also imported a large quantity of very pure nitrate of soda. A mixture of these two manures constitutes, as I have just stated, an excellent top-dressing for young corn.

In reply to a vote of thanks, Mr. M'Ivor took occasion to recommend that each society should appoint delegates to a conference to be held annually in Melbourne, when all subjects appertaining to the welfare of agriculturists could be taken into consideration, and efforts made to advocate and protect their interests. They knew that "union was strength," and without it they could not hope to obtain a recognition of the importance of the position they held in the country. If they were to act in unison, they would be able to go to any Ministry, and not beg as a favour, but demand as a right, that justice should be done them, and they would soon find that their wants would be speedily attended to. Regarding the scheme submitted to the Government by Mr. Wallis, Secretary for Agriculture, he considered it an insult to agriculturists. The sum to be paid to the teacher at the head of affairs at the establishment at Dookie was totally inadequate for a qualified man, and would only result in the engagement of an incompetent person, and ultimate failure. A competent man would not undertake the position and responsibility for less than £1,000 a year, and yet only £1,200 a year was set down for the whole expenses of the farm. To ensure success good men would have to be placed in the responsible positions. He would like that the Government should establish an experimental farm in each district, which should be under the control of the local Agricultural Society, whose duty would be to see that the recommendations of the scientific and practical men appointed to lecture and direct affairs were properly carried out. Much good would result from the inauguration of such a system, as the young agriculturist would thus have placed within his reach the means of observing the results of science and practice combined. In conclusion, he urged them to agitate for the means of acquiring scientific knowledge as applied to agriculture, for if they obtained that, the practice would come of itself.

THE STORING OF GREEN FOOD IN PITS.

THE system long practised in parts of Austria and Germany, of storing green Indian corn, lucerne, sainfoin, grass, &c., in pits, is now coming into favour in France; and amongst the first to adopt it was M. Goffart, of Château Burtin, in the Department Loir et Cher. From a little pamphlet lately published, we learn that his experience in the culture and pitting of Indian corn dates from 1852; and, repeated trials having convinced him of the superiority of sour maize as a winter food, he has since then been constantly endeavouring to solve the problem how to pit large quantities of the forage crop in question in the cheapest and most satisfactory manner. Château Burtin is now visited every year by a number of agriculturists anxious to acquaint themselves with his present successful mode of procedure; and a short account of the method adopted, with a glance at the results obtained by the use of the maize as cattle food, may not prove uninstructive.

At first M. Goffart cultivated the variety of Indian corn mostly grown in his neighbourhood; but as the same did not give sufficient bulk of fodder, "horse tooth" maize was substituted for it. This yielded three times as heavy a crop, but latterly the preference has been shown for a third variety—the giant or caragua, which also yields well as regards quantity of green food, occasionally producing nearly sixty tons to the acre. In 1874 the average was fifty-one tons. As these results would lead one to suppose, the land round Château Burtin is particularly well adapted to the crop. The best produce is that obtained after forage rye; the stubble being buried by a shallow ploughing, and the seed shown thinly (about a bushel to the acre) by hand. No manure is applied to the land for the Indian corn, but it receives in the autumn, for the preceding crop (*i.e.*, rye), about twelve tons to the acre of farm-yard dung, and as a top dressing in spring, a mixture consisting of 2 cwts. of super-phosphate of lime, and 1½ cwts. of sulphate of ammonia. M. Goffart's experience does not confirm the opinion sometimes heard, that the culture of maize greatly exhausts the soil. He has repeatedly taken three crops of it in succession without diminution and has even obtained a greater weight in the case of the third, than that of the first crop; he has also, without applying any manure, gathered heavy crops of wheat after maize.

With respect to the construction of the pits at Château Burtin, the largest—36ft, in length by 6ft. in depth and width—has well-pointed stone wall sides, and paved bottom, bonded with cement. A second adjoining it, is not walled round, but has like the one just alluded to vertical sides, so as to facilitate the pressing down of its contents. The largest costs about £11 to make, and frequently contains forty tons of green maize, mixed with about one-fifth of its weight of rye-straw chaff. In December 1874 M. Goffart, had in his different pits as much as 250 tons of Indian corn, this having been cut into chaff by a machine (driven by a 5 horse power engine) delivering from 120 to 130 cubic yards per diem. He prefers ½in. to 1in. or longer chaff because it occupies a smaller space, assuming a more compact form, and excluding the air better. Sometimes bran is mixed with the forage crop, the quantity of the same, as also of the straw chaff to be added, depending on the more or less dry state in which the maize is harvested. The amount added never, however exceeds the proportion of one fifth.

Concerning the *modus operandi* in preparing a pit: as fast as the fodder falls into the latter from the chaff-cutter, it is spread out and firmly trodden under foot by two men. When the pit is full, and the centre part raised so as to form a conical heap, some of the maize is placed beyond the sides; and this outside portion, extending all round to about 1½ft. from the walls, requires to the firmly stamped down like the rest. Some salt is sprinkled on the uppermost layer, then come a coating of long straw, and finally a covering of earth 1½ft. deep. For some time after the completion of the above work, the pits used to be carefully examined every day, as owing to the settling down of the fodder cracks are apt to form in the roof, and these, if not closed, would admit a quantity of air, and injure the maize by turning it mouldy. The same danger is incurred to some extent whenever a portion of the provender is taken out for feeding purposes, and on these occasions the precaution has to be observed of covering over the exposed parts again as quickly and completely as possible. With regard to the cost of the above operations, as also of reaping, carrying, and cutting up the maize, the total expense is estimated not to exceed 10*d*. to 11*d*. per ton (1/. to 1/. 10*d*. per 1,000 *kilos*.

After a series of comparative trials, M. Goffart has come to the conclusion that, in his neighbourhood at least, sour Indian corn is the cheapest and best forage crop for diary stock. He finds the milk of his twenty-eight head of cattle never richer, nor the butter made from it better flavoured, than when the cows are being kept exclusively on this food, and the process of fermentation it undergoes has the effect of increasing its nutritive value. 65lbs. to 70lbs. of slightly soured maize and straw chaff, taken from the pit after Christmas, appear to contain as much assimilable nourishment, or to go as far, as the 110lbs to 130lbs. of freshly harvested maize which a cow will consume in twenty-four hours in the autumn. The pitted winter's keep has of course become gradually more consolidated owing to constant evaporation; but this alone would not suffice to account for its superior feeding value.

Referring to the complete bill of fare for dairy stock at Château Burtin, the year is divided as follows: Dec. 15 to April 15, soured maize and rye-straw chaff; April 15 to June 15, freshly-cut forage rye, given in the form of chaff; June 15 to Sept. 1, mustard cut into chaff and pasture; and Sept. 1 to Dec. 15, either freshly cut or pitted maize chaff.

M. Goffart's favourable opinion of the system of storing and preserving forage crops in the manner described, is shared by most other French agriculturists who have given it a trial; and it may perhaps be of interest to glance at the reports which two of them—M. Lecouffe and M. Sottom—have lately published on the subject.

The former, in a communication to the Lille Agricultural Society, dated Aug. 31, 1876, states that his pits are constructed of brick, built on the slope of a hill to facilitate the escape of moisture, and made broader above than below to prevent the formation of hollow spaces when the food settles down. The exact dimensions of his pits are 4½ft. in depth by 9¾ft. in width, increasing at the top to 10½ft., and, to exclude the air more effectually, a layer of beetroot pulp is placed above the chopped maize. Of the latter plant—the caragua variety, taken after clover and forage barley on well-manured land—M. Lecouffe harvested in 1875 forty tons per acre, or, in all, 147 tons, cutting up the same with a chaff cutter, driven by a six-horse power engine. His experience with pitted or preserved fodder, both with and without the admixture of straw chaff, has been highly satisfactory, and he strongly recommends its employment in the cattle-stall in conjunction with linseed cake turnips, &c.

M. Sottom, the second gentleman alluded to, writing to the *Journal d'Agriculture Patrique* from Gers, in the south of France, fully endorses the estimate formed of the sour-keep by M.M. Lecouffe and Goffart, and has found it excellent food for working oxen. During the last five years he has been in the habit of pitting green maize and sorghum, and he now preserves aloes, and in the same way, red clover, lucerne, sainfoin, &c.

The greater "proofiness" of the soured food, in the case of sainfoin lucerne, and vetches, he ascribes to the fact of the crop being allowed to remain standing longer than it would if fed green or made into hay. The coarser woody portions, which, under ordinary circumstances, the cattle would refuse to eat, or which would pass through their bodies undigested, are rendered soft and assimilable by the process of fermentation, and the somewhat acid taste and peculiar penetrating aroma which the fodder acquires cause it to be consumed with avidity.

In Germany, where, as above stated, the system of storing grass and forage crops has long been followed, some farmers are opposed to the common practice of sprinkling salt on the different layers in the pit, maintaining that the salt does more harm than good, by unduly retarding fermentation, and rendering the lower portions, to which it sinks over salty.

Opinion differs also as to the degree of ripeness the crop should be allowed to attain before being cut; but the leaves and flowers (particularly in the case of clover) are never allowed to become so withered and dry that they drop off during transport. A very succulent crop will heat quickly in the pit, and acquire a darkish colour and disagreeably pungent smell. There is less danger, however, to be apprehended from over succulency than from over-wetness; and careful farmers avoid carrying and housing their green food as long as the latter is saturated with rain or dew. Generally speaking, it requires to remain at least six weeks in the pit before it is in a state fit for consumption. As the presence of an excess of lactic acid—the acid to which the sharp taste is due—may cause the sour-keep to act as a purgative, and even bring on diarrhoea, a certain amount of caution is necessary in feeding with it. When, occurring only to the ordinary extent, and the cattle are in a healthy state, no fear need be entertained; the acid then appears to serve the useful purpose of promoting digestion.

In certain parts of Hungary, a plan frequently pursued is to partially dry the forage crops previous to storing them, and those who follow the Klappmayer method of so-called "brown hay" making, place straw between the different layers in the pit. The maize is in that case not cut up into chaff, nor given to the cattle without some supplementary food. On the Archduke Albrecht's farms at Ungarisch-Altenburg, oats are added for horses, and crushed corn of some kind, oil cake, beetroot, peas, or tares for cattle, according as the latter may be dairy or fatting stock. Of the sour-keep, the milch cows receive daily 2¼ per cwt. of their live weight fatting cattle 3 2/5, and sheep 4 2/5; and in most localities 25 lb. per head represents about the usual quantity given to horned stock, whether of preserved hay or maize.

At Bajna and Bia, two of Prince Metternich's Hungarian farms, the cattle get along with their sour food in spring, about the same amount of other provender as is ordinarily given with roots; and, as regards construction of the pits, these owing to the soil being a stiff clay, do not require to be walled round. The farm manager estimates the cost of harvesting and storing the green Indian corn at 1*s*. 3*d*. per ton (8 *kreutzers* per 50 *kilos*).

Two no slight advantages connected with the pitting system are, the economy of labour it allows of, and the comparative independence of the weather the farmer adopting it, enjoys in harvesting his forage and herbage crops; and this method of storing green food is, therefore, one well worth the attention of Indian agriculturists.

CORN PRODUCTION.

A RECENT number of *Frühling Landwirthschafliche Zeitung* gives an interesting *résumé*, drawn from official sources, of the average production of grain, in the more important countries of the world. The amounts are calculated in *hectolitres*, each of which is equivalent to a fraction of 2¾ English bushels.

	Hectolitres.
Russia	653,000,000
North America	536,800,000
Germany	260,000,000
France	249,000,000
Austro-Hungary	171,000,000
Great Britain and Ireland	118,600,000
Italy	102,600,000
Spain	90,000,000
Lower Danubian Principalities	73,600,000
Canada	35,600,000
Denmark	25,200,000
Sweden	25,100,000
Belgium	23,500,000
Egypt	14,300,000
Holland	11,200,000
Portugal	11,100,000
Australia	11,100,000
Chili	6,100,000
Norway	5,100,000
Greece	4,400,000
Switzerland	3,500,000
	2,430,700,000

The great importance of Russia and the United States of America as bread-providers for the world, is here apparent, especially if it is remembered that of Russia's contribution about 100,000,000 *hectolitres* is in the form of wheat; and that America, besides supplying wheat to about the same extent, furnishes 334,000,000 of her balance in the form of maize. Russia uses rye and oats chiefly for home consumption, but exports from 18,000,000 to 20,000,000 *hectolitres* of wheat annually, to foreign countries, That Germany and France have long ceased to grow enough for home consumption, and are obliged to supply the deficiency by importation, is accounted for partly by the increase in population, and partly by the fact that as corn-growing ceases to be profitable more attention is paid to stock-raising and pasturage. That Austro-Hungary has been obliged to resort to importation of late years is still less to be wondered at, for the 33,000,000 *hectolitres* of wheat, 88,500,000 of rye, 26,500,000 of barley, 42,333,333 of oats, and 23,333,333 *hectolitres* of maize, which constitute her average ordinary crop, is obviously insufficient for the wants of her 37,000,000 of population. A comparison with Great Britain and Ireland shows this even more plainly, for here, with a population of 32,000,000 only, importation to the extent of about 5,000,000 tons of grain are required annually, in addition to the 118,600,000 hectolitres of home-grown produce. The importance of the Danubian Principalities as corn-growers is chiefly explained by, their small home consumption, which is of such insignificant proportions that in the three years 1873-5, they were able to export some 10,000,000 *hectolitres* of grain over the Sulina alone. On the whole, the countries enumerated above are readily divisible into two classes, the one destined to regular export, and the other to systematic import. To the first belong Russia, North America, the Danubian Principalities, Canada, Denmark, Sweden, Chili, Australia, British India, and Egypt; and to the second Great Britain and Ireland, France, Germany, Belgium Switzerland, Holland, Italy, Norway, Spain, Portugal, and Greece. Midway between the two oscillates the Austro-Hungarian monarchy; which, from the experience of late years, seems inclined rather to an export of surplus than to importation of a deficiency from neighbouring States, but is nevertheless in years of scarcity either absolutely neutral or an importer on a small scale.

AGRICULTURE IN BRAZIL.

(The Queenslander.)

BRAZIL is amongst the nations which are advancing rapidly in agriculture. The Emperor Don Pedro is a man of rare intelligence, which he brings to bear largely for the benefit of the agricultural interest of this country. For some two years past he has been travelling in America and Europe and sending home machinery and implements that seem suitable to the wants of Brazillians. He is ably seconded by the staff who accompany him, and by the excellent institutions in Brazil.

In connection with the Central Exhibition, at which the Emperor spent nearly two months, minutely, early and late examining the products of the various nations, a volume has just reached us, in which we find much that seems of interest to colonists situated as we are, in many respects, under circumstances not unlike those of Brazil:—

The nation is essentially agricultural; the larger portion of the people being engaged directly in farming. Particular attention has been directed to the culture of maize. The grain is the staple bread yielder of the country Some one hundred and fifty varities are grown, and many of them must be very fine. Rye and beans also are grown largely; of the later some one hundred and twenty sorts are grown, several of them being indigenous to the country. Coffee, sugarcane, cotton and tobacco do well, cocoa, vanilla, tea, and all Asiatic plants thrive in others; the climate and soil favor European fruit trees, cereals and legumes. In these provinces, coffee and sugarcane are cultivated as staple products, but wheat, barley, rye, the vine, pear, apple and peach trees are also planted with profitable results.

The advantages obtained from the culture of the coffee tree are evident to all who know, even though imperfectly, the results which it has produced in the empire. One *hectare* of land can contain 918 coffee trees, which on an inferior soil yield 674 *kilograms* (about 5 cwt. per acre) on medium soil 1,384, and on superior soil 2,022 *kilograms* of bean (about 16 cwt. per acre). An active man, as a rule, takes charge of two *hectares* under coffee, and may therefore in the first case obtain an income of 404,400 *reis*; in the second of 830,000 *reis*; and in the third of 1,213,200 *reis*, taking the coffee at the low price of 300 *reis* per *kilogram*. On an average coffee estate, the mean production of each labourer, of either sex, is 600,000 *reis* a year.

The culture and preparation of coffee, sugar, cotton, and tobacco have been considerably improved by the introduction of machinery and improved processes. With regard to coffee, the chief article of Brazillian agriculture, no country produces so much, or of better quality. The first of these truths is now generally acknowledged, the other is also beginning to be so, by unbiased persons who take the trouble to examine the subject.

Agricultural societies established in the capital and in some provinces, have greatly contributed to the improvement noticed in the culture of staple products. Agricultural institutes, created by Government, and others with funds of their own, not only directly, but through the municipal committee, indirectly, promote improvements in agriculture. This joined to the construction of new roads; to the improvement of existing ones; to the greater expansion given to coasting trade and to navigation; to professional schools already created at Rio de Janeiro, in several provinces and lately in that of Minas Geraes to the establishment of territorial banks, and the introduction of intelligent and industrious colonists, which the State constantly promotes, will doubtless contribute to a better distribution of rural landed property in Brazil, and to raise agriculture to that degree of perfection to which the country aspires. To this result will also contribute national and international exhibitions, which these institutes inaugurate at fixed dates, granting prizes to agriculturists who excel. A project of the Imperial Agricultural Institute of Rio de Janeiro for these exhibitions in the capital of the empire is, at the present moment, under examination by the Government. A bill for reforming public education, presented by Government to the General Assembly, creates at the expense of the State, in rural districts agricultural schools.

The great impulse lately given to rail-roads and the reduction in their tables of freights greatly contribute to facilitate intercourse between producing centres and consuming markets, and to increase the prosperity of agriculture. The establishment of rural banks will also powerfully conduce to the same. The powers of the State, convinced of this necessity, have authorised the incorporation of an important company, with the faculty of issuing mortgage bills, up to ten times the value of the fixed capital of 40,000,000 *milreis*. Government guarantee to the company 5 per cent. interest, and a sinking fund for the respective bills, on condition that the bills be issued in European markets, and that the bank lends money on rural land property, at a rate of interest not exceeding 7 per cent., with a sinking fund, calculated for the time that the loan is to last, between five and thirty years. The bank has also to establish branches, which must embrace the more important portions of the territory of the empire in places designated by Government in combination with the administration of the company. Loans may also be made to rural land-holders, on implements, on fruit trees, and on crops, as well as on domestic animals, and other accessories not included in the mortgage. This pledge will enjoy the same privileges as commercial pledges, and shall remain in the hands of the mortgager, being inscribed in the mortgage register, as guarantee for the mortgager.

The necessity for the division of labor is daily becoming more sensibly felt, and the rural population of the country is beginning to acknowledge the fact. Many planters cultivate coffee, which others prepare for the market, and there are now some industrial establishments which receive coffee in the berry, and for a moderate contribution hull or wash, and prepare it according to the most approved methods. In the city of S. Fidelis, province Rio de Janeiro, there is a large establishment of this kind, with excellent machinery worked by steam power.

The legislative assemblies of these provinces have authorised the President to sign the respective contracts with a guarantee of 7 per cent. per annum on a capital of from 300,000 *milreis* to 500,000 *milreis*, binding those who purpose realising enterprises of this nature to offer certain advantageous conditions to planters, and to found free primary schools for the children of the operatives, and of the poorer inhabitants of the neighbourhood.

AGRICULTURAL STOCK.

A PRIVATE letter, received by the Dacca paper from Cachar, states that the disease known as the Munipore disease is making sad havoc among the Munipore ponies. In about fourteen days' time no less than two thousand had fallen victims to this fatal malady.

POULTRY :—The true method of managing all kinds of stock is to take advantage of their nature and assist it to the advancement of their keeper's interests. To induce a hen to lay, let the nest be partly shaded. When she wants to sit, if you wish to remove her, do it at night and make her surroundings as nearly as possible like those of the nest she laid in. In a compound where there are many nooks and corners, and where there is some one to attend to the fowls, boxes may be put up in a number of places, and the fowls will select and lay, each in her favorite nest, and when the time for sitting has come, each will go to her accustomed nest without much changing or confusion; but where the accommodation is more limited, more attention must be given to the nests, If fowls have liberty, they need not have much food. A lot of oyster shells, thrown down on a road or yard over which horses travel, is very good for poultry. Pure water is essential and should there be any stagnant pools of dirty water about, fill them up immediately. Drinking impure water is a source of disease that should never be tolerated. Animal food should be given except where there are plenty of snails and earth-worms. Feed liberally with grain and your hens will generously reward your liberality.

THE *Journal of Chemistry*, in discussing the question of fattening cattle from a scientific standpoint, says that poor animals consist of about two-thirds water, while fat ones have one-half, in the total weight, and compares poor animals to bog meadows. When the fattening process begins, water commences to disappear, and fat or suet takes its place ; the increase in bulk during the process being largely of adipose matter. It is a curious circumstance that, during the fattening, the proteids, or nitrogenous compounds, increase only about seven per cent., and the bone material, or inorganic substance, only one and a half per cent. The cost to a farmer of fattening an ox is much greater at the close of the process than at the commencement ; that is, increase in bulk or dry weight at that period is much more costly. If it costs three cents a pound for bulk for the first month after a poor animal is put in the fattening stall, it will cost five cents the last month, If, then a farmer consults his money interests, he will not carry the increase in fat beyond a certain point, provided he can turn his partially fattened animals to fair advantage, The flesh of a fat animal in every case is much richer in fixed, nourishing material, than that of the lean, and it is never good economy to purchase lean beef. It is better to purchase the poorest part of a fat animal than the best of a lean one, The best piece of a fat ox (the loin) contains from twenty-one to twenty-eight per cent. more fixed material than the corresponding piece in a lean one, and curiously enough the worst piece in the lean animal (the neck) is the richest in nourishing material, The flesh of the neck improves very little in fattening, hence, economy considered, it is the best portion to purchase, as its value is in a measure a fixed one.

FORESTRY.

WE hear from Bangalore that a specimen of *Magnolia grandiflora* is now to be seen in flower at the Lal Bagh Gardens. The *Magnolia* is a native of California, and appears to thrive well there.

WE are informed that the Spanish chestnut, a very handsome tree, has been proved to grow well in the Neilgherries and southern slopes of the Himalayas. In Sim's Park, Coonoor, in the private grounds of " Woodlands," in the Ootacamund Public Gardens and at Llangollen (Mr. Frend's) this chestnut may be found, growing well.

WE understand that on the recommendation of the Government of India, the Secretary of State has sanctioned the appointment, as a temporary measure only, of an additional Conservator of Forests in British Burmah for one year. It is believed that some addition to the present strength of the Forest Department in Burmah may before long become advisable.

OWING to the large local demand for timber in Cachar, forests in that district promise to show very satisfactory results hereafter. Change of system consequent upon Government for the first time assuming a detailed management of these forests, resulted, last year, in a temporary check to the timber trade, which we hope will hereafter be rectified. The authorities are scrupulously exacting in demanding from Europeans—such as planters, &c.—a strict observance of the law that protects valuable timber from spoliation.

COLONEL KEATINGE, while deeply regretting the decision arrived at by Government regarding the income derived from Soom Forests and Elephant Mehals, shows that the grand total of expenditure gives a nett increase of Rs. 28,036 in 1876-77, over the previous year, and an excess of Rs. 8,351 in expenditure over receipts. The figures for the two years are—1875-76. expenditure Rs. 61,883 receipts, Rs. 81,568. In Cachar, the forest reserves showed a surplus at Rs. 676 in 107,301 ; 1876-77 expenditure Rs. 89,919, in receipts over expenditure ; all the other divisions under the direct management of the Forest Department were necessarily in deficit, conservancy having only just commenced. The greater part of the revenue, *viz.*, Rs. 42,349, was collected by the district officers. On the whole, Colonel Keatinge seems to be of opinion that, the financial results of forests management in the province, during the past year, exhibit as satisfactory results as can fairly be expected, in the present early stage of operations.

FROM the forest administration report in British Burmah for the year 1876-77, we are glad to see that considerable progress has been made in the demarcation of reserved tracts during the year. The hands of the Forest Department have been strengthened by appointing an additional conservation and the province is now divided into the Tenassarem and Pegu circle. At the end of 1875-76, the area of the State *reserves* in the Tenasserim circle amounted to some 17 square miles. During 1876-77, an additional area of 47 square miles of proposed reserves was demarcated, and the necessary surveys and maps completed, for the reserve of a further approximate area of some 170 square miles, of which 137·5 miles were in the Attaran district alone. In the Pegu circle, the area of State reserves, which at the close of 1875-76 was represented by 597 square miles, was increased by 16,896 acres, or 26 square miles, consisting of fuel reserves exclusively; but sanction has since been given to the settlement of the Thongzai teak reserve, comprising some 70 square miles ; and of five others, aggregating 159 square miles ; while about 400 square miles besides have been selected for reservation in the Tharrawaddie division. It is anticipated that during 1877-78 a total of 700 square miles will have been added to the area of the State forests in Pegu. The future yield of the teak producing areas is carefully maintained and insured by a system of teak plantations and by protecting the existing forests from fires and thus giving teak seedlings a chance to spring up. The Conservator reports the entire failure of the *Hevea elastica* seedlings brought out by him in Wardian cases from England. Only some 12 plants reached Kurma alive : these were transferred to Mergui, where they sickened and died. A few plants of the Para India-rubber variety of the *Hevea* were got from Dr. King, of the Botanical Gardens, Calcutta, and those are reported as thriving well at Mergui. Ten acres were added to the area under cinchona cultivation in the Sittang division, of which five acres were actually planted during the year, and a considerable amount of transplanting took place. Some 4,000 seedings and cuttings of the *cinchona condimmi* were supplied to Missionaries, who report that this species has not done so well as *cinchona succirubra*, which grew admirably. The cultivation of all kinds at Magayee is so scattered and unequal in distribution that the actual cost of individual experiments can only be ascertained after much trouble ; but pains should be taken to avoid burdening any particular experiment erroneously with expenditure foreign to it, and so creating a false impression as to its actual value or the reverse. The Government of India have called attention to the annual cost of the cinchona plantation at Thantoungyee on the Sittang, which seems to increase year by year ; and the Conservator's report on this, which is awaited, may possibly reveal errors in allotting the charges, which would materially alter the figures. In former years, there was undoubtedly great laxity in apportioning the charges on these minor-operations ; but the subject is now claiming more attention.

DURING the year, Mr. James Lee, Overseer in the South Tenasserim division, was specially deputed to examine the resources of the islands in the archipelago, to obtain information as to the nature and quantity of the forest produce removed thereform, and its destination after extraction—to glean all particulars available relative to the akyaw or eagle-wood tree (*Aguilaria agallocha*) and its extraction, the season at which the produce-collectors visit the islands, and the localities from which these people come. Mr. Lee submitted an intelligent and interesting account of his visit. The islands, which vary considerably in size, number in all some 2,000, but only a few of the larger ones could be visited and reported on. The result as regards the akyaw tree was, that the lumps of hardened scented resin, found imbedded in the trunk, form the only valuable item of forest produce removed from the islands. Insect dammer, honey, and bees-wax are also collected but are not plentiful, seldom more than 50 or 60 *viss* of each being gathered in one year. It is estimated that about 1,000 *viss* of "akyaw" are removed annually,—the price varying from Rs. 3 to Rs. 22 a *viss* (3½ lbs.), and probably equal in value to an average total of Rs. 10,000. Very little is known of the natural history of the tree, and even its identity seems to be a matter of dispute. Mr Lee describes it as the largest tree in the forest,—one which he saw felled girthing eight feet-and-a-half at eight feet from the ground, and measuring 72 feet from the ground to the first branch. The natives say that there are two distinct kinds of tree which each yield precisely the same substance; but this can only be decided by seeing both trees in flower, as in other respects they look very much alike. The Selungs who inhabit the islands, and whose numbers appear to be decreasing—there being now a population of only 600 souls in all the islands—barter the "akyaw" with the Malays and Chinese who visit them for tobacco, paddy, cloth, and occasionally opium. They have few means of gaining a livelihood, except by fishing; they are not cultivators, and from their timid natures are very shy of strangers. It has always been difficult to get access to them on account of their vagrant habits, and there can be little doubt that if the right of collecting the "akyaw" was farmed out to an outsider it would lead to acts of oppression. The suggestion, therefore has not been entertained. From Mr. Lee's report, the formation of the gum or resin in the tree would appear to be invariably the result of injury done to the tree by *dah*-cuts: at all events, the akyaw is found in the minutest particles only in healthy living trees, while in the decayed portions of trees that have been felled it is met with in abundance. It is suggested that the yield might be increased by auger-borings, and experiments will be made. Some 8,000 trees in all are said to be cut down annually on the various islands, but there is little doubt that the work of destruction is greatly aided by every large tree which is felled bringing down with it in its fall two or three others. The greater bulk of, the "akyaw" collected is sent to Singapore for shipment to China, where the small pieces are used for torches, incense, and medicine.

WHILE introducing the new Forest Act in the Supreme Council Mr. Hope quoted the views regarding the arboricultural condition of Southern India, recently expressed by a distinguished administrator, which are as follows :—

"The southern peninsula of India has been or is being denuded not only of its forests but also of its jungles, its brushwood, its groves, its trees. The denudation has been, as I understand, going on near the sources and the upper courses of the many rivers which water the country. This, perhaps, is being in some degree checked. But with the progress of coffee-planting, and with the assertion of communal rights on behalf of the people, the utmost vigilance will be needed to keep it within bounds. If it were to proceed unchecked, there would be imminent danger of the rivers running dry by reasons of the catchment basins and the drainage areas near their sources being rainless. And as these rivers supply the great canal systems, this danger has only to be mentioned in order to be felt. The same argument applies in a lesser degree to the tanks or lakes which are second only to the canals in usefulness for irrigation. It has already been seen how precarious is the position of these reservoirs, even with one year's drought. The progress of the country causes the prices of timber and of firewood to rise. The introduction of railways has, in the absence of any local coal-mines, greatly augmented the demand for fuel. Strong temptations are thus inevitably offered to the people at large to fell, cut and lop recklessly; to bring every log, stump and stick to market; to dig out the very roots of the jungle, so stopping any chance of reproduction, without thought for the future. There are stories to be heard everywhere of groves and hedgerows and scattered trees being cut for sale. In the midst of cultivated tracts there are to to seen bare, sterile hillsides, which have been forest-clad within living memory. In such localities the climate is supposed to have changed for the worse, Beyond the Ghat mountains, Bellary and Kurnool, the treeless, shrubless aspect of the country is as wonderful as it is melancholy. These are the very districts where famine has been occasionally epidemic, and where scarcity is almost endemic. Any thoughtful spectator must perceive that, according to all meteorological experience, and to the almost certain teachings of proved facts, these fine districts were not destined by nature to be the prey and sport of famine or scarcity, but have been rendered subject to these calamities by the thoughtless action of man. Even the numerous groves planted in the last generation by the great Collector, Mr. Robertson, whose name is still a household word, were made over many years ago to the villagers and have been mostly cut down. Trees, jungle and forests must indeed be thinned and cut for the use of man; but they need never be exhausted, and something might always be left for reproduction."

Nothing could be more true and worthy of attention than those graphic and practical remarks. Regarding the necessity for regulating the use of forests in the interests of the public, Mr. Hope concluded by quoting the opinion of the Secretary of State not very long ago communicated to the Government of India :—

"Her Majesty's Government as you are aware, is fully impressed with the importance of the adoption of efficient measures for preserving the forests of India, whilst they admit also the necessity of those measures being so framed as to interfere as little as possible with private rights, which may have grown up on behalf of villages or individuals. On the other hand, it must be remembered that as civilisation advances these rights become less and less necessary to the cultivators, and are found frequently incompatible with the superior rights of the whole community, among whom the cultivators themselves obtain advantage in other ways from the restriction of their ancient privileges. The change of this state of things must be gradual, and so timed as to make the transition as little onerous as may be to those who have held such privileges. In the instance before us, it must be remembered that the absolute concession of these privileges would, as a rule, render the effective preservation of the forests impossible, and moreover, that this is not an object of private import, but is undertaken by Government for the benefit of the whole community. It may be added that all the measures already adopted for several years past must have tended to prepare the minds of the inhabitants of the villages for a change of the nature indicated."

SERICULTURE.

GOVERNMENT is said to have at last sanctioned the experiment in sericulture, recommended by the Superintendent of the Doon.

THE new Government silk manufactory in Japan, with machinery of the latest type from Europe, has commenced work. There are thirty-three men and fifty-two women, at present employed in the factory.

IN one of the French scientific journals it is stated that a mere variety of food will produce variety of colour in the silk produced by the silkworm. We thought this fact had been well known everywhere. Monsr. Delidou, of Saint Gilles (Véndee, France,) Monsr. Mignot, and others, have discovered that silkworms fed on

Vine	leaves	produce	Red silk
Lettuce	,,	,,	Bright emerald green
Mulberry	,,	,,	White ,, ,,
Cherry	,,	,,	Clear yellow ,,
Pear	,,	,,	Deeper Yellow ,,
Apple	,,	,,	Nearly white ,,

This discovery may possibly have some effect on the quality of the silk, by obviating the necessity for dyeing the manufactured article.

A more valuable discovery is the alleged fact that the moth, on escaping from its cocoon, by eating its way through the threads, merely pushes them aside, and so leaves the cocoon uninjured. If this observation is verified, it will be the means of bringing into use millions of cocoons which hitherto have been left unused, under the idea that the threads were broken, and that they were consequently useless.

RAW SILK AND THE SILK TRADE.

M. N. RONDOT, Member of the international Jury for the French Department, published some time since a most interesting report on the silks shown at the Vienna Exhibition, which we publish below. Its statistical details are very important :—

The silk manufacture, whose history goes back to the earliest ages, has now spread over almost all parts of the globe. Born in the extreme East, it long formed the riches of the great nations of Asia, China, India, and Persia, which preceded Europe in the arts, but neither obstacles nor resistance stopped its progress and establishment in the countries of the west. It has been introduced into the regions of the north of Europe, and in the American States, watered by the Pacific Ocean. More than 2,000 silk workers, belonging to 25 nations, represented at Vienna in all its degrees this interesting branch labour—we say 2,000, although not much more than 800 individual names are given, because there were numerous large collective exhibitions of silk made by countries and towns formed by a great number of manufacturers. At no previous exhibition was the silk industry better represented in all its characteristics in different countries. Nor at any exhibition were the difference in the constitutions of the manufacture, in the processes, and the results more strongly brought out. The display was not only large, but was honest and instructive, by showing in certain quarters inequality and weakness. The silk manufacture has not arrived like other textile industries at the last stage of its organisation. In no country in Europe have they yet entirely abandoned the processes and habits of isolated labour, but the reform is gradually making headway by degrees, and increases, notwithstanding the difficulties and hesitations, by the pressure of circumstances, and the changes of fashion, which, by throwing out brocades, and favouring simple colours, are creating a new element in this industry. The manufacture does not present the same difficulties, and requires less care. The weaving can be carried on in the country; power looms can be multiplied. For 15 years, however, the power loom in large factories, and the hand loom, at the domestic hearth, or in small workshops, have been carried on simultaneously. There is scarcely a country where the rearing of the silk worm has not been introduced; neither have the people of the frozen or torrid zones given up the hope of naturalising it The efforts which have been carried on in the north of Europe, in south Africa and the two Americas, with a perseverance only followed by failure, are but of interest from the fact of supplying healthy seed whenever required. Attention was specially directed to the products of Italy, France, China, and Japan, and the silk manufacture of each of these countries was represented by remarkable collections. Silk is also produced in Austria and Hungary, Switzerland, Spain, Portugal, Greece, Turkey, Russia, Persia, India, and the States of Central Asia. The following table is sufficiently near the truth, to show the actual position of the silk trade;

Raw Silk sent to the Markets of Europe.

European silks—	1872.	1873.
	Kilogrammes.	Kilogrammes.
Italy	3,125,000	2,366,000
France	637,000	549,000
Spain and Portugal	180,000	135,000
Turkey in Europe and Greece	40,000	107,000
	3,982,000	3,127,000
Asiatic silks—		
China	3,390,000	3,080,000
Japan	721,000	700,000
India	574,000	486,000
Asiatic Turkey	185,000	250,000
Persia, Khorassan, Caucasus	220,000	441,000
	5,090,000	5,060,000

Making a total of 9,072,000 kilogrammes in 1872, and 8,187,000 in 1873. The European silk factories used in 1873, 62 per cent., of the Asiatic silks. The proportion was about the same in 1871 with different qualities:—

European silks.	Kilogrammes.
Italy	1,260,000
France	600,000
Spain	300,000
Turkey in Europe and Greece	530,000
Asiatic silks.	
China	2,300,000
India	600,000
Persia and the Caucasus	550,000
Asiatic Turkey	120,000
	6,260,000

The Lyons manufacturers consume less of the Asiatic silks than foreign countries, the proportion being about 39 per cent.

Italy.—The rearing of the silkworm and the manufacture of silk has long formed one of the riches of that country. It was introduced into Sicily by the Arabs from Africa. It has spread over Italy from its first hearth up to the Alps, and if it has not always maintained the first rank for the quality of its products, it has not ceased to increase and flourish. The product before the epidemic was 3,710,000 kilogrammes of raw silk, corresponding to 52,000,000 kilogrammes of cocoons. The Italian Goverment, indeed, estimated it at 4,523,000 kilogrammes of silk. (Ital. Off. Cat. London Exb. 1862.) It fell to 1,731,000 kilogrammes in 1864. Since then it has been:—

	Kilogrammes.		Kilogrammes.
1865	1,762,000	1871	3,473,000
1868	1,930,000	1872	3,125,000
1869	2,150,000	1873	2,960,000

The export of raw and thrown silk has been as follows from Italy:—

	Kilogrammes.		Kilogrammes.
1861	2,385,091	1868	2,180,567
1862	2,382,226	1869	2,292,018
1863	2,604,895	1870	2,164,982
1864	2,105,014	1871	3,255,000
1865	1,525,781	1872	3,081,200
1866	1,865,854	1873	3,335,900
1867	2,051,938		

Besides this there was exported in 1873, 2,[illegible]04,300 kilogrammes of waste silk, and 117,025 kilogrammes of silk manufactures, in all worth £16,585,916. In addition to this native production, the Italians also work up about 645,000 kilogrammes of foreign silk received annually.

France.—About twenty years ago no nation equalled France for the magnitude of its operations in the spinning and working of silk. In 1853 the crop of cocoons was about 26,000,000 kilogrammes according to some authorities, and 21,000,000 according to others, equal to 2,166,000 or 1,750,000 kilogrammes of raw silk; in 1873 the crop was only 8,240,000 kilogrammes of cocoons, equal to 550,000 kilogrammes of raw silk. Taking the average of the three years ending 1873, the production in Italy is five-sevenths, and in France two-sevenths of what it was in 1853. But it cannot be denied that France still holds the first rank for the importance of its silk manufacture, decimated and neglected as it has been. An industry which gives occupation in rearing the worm to 180,000 families, and receives for the cocoons 60,000,000 francs; which also employs in the manufacture 642 filatures, furnished with 26,500 basins, and 927 spinning mills, working 942,000 spindles and reels, besides 105 mixed factories, cannot but be important. The number of hands employed in the raw silk factories in 1873 was 69,588, of whom 7,467 were men, 51,136 women, and 10,985 children. Those employed in spinning and weaving numbered 73,255, of whom 34,978 were men, 35,825 women, and 2,452 children. The number of factories was 972. The number of power looms working was 19,210, of hand looms, 77, 811. The spindles at work were 843,326.

MINERALOGY.

WE hear that it is intended to sell off the tents, machinery, &c., used at the Oregaum gold fields. We don't believe that it is intended to give up the fields as a bad job; the ascertained results, under very unfavorable circumstaces, go to show that the gold fields will pay.

A LARGE specimen of the Akyab coal was submitted to Mr. Medlicott for opinion, and he reports that from analysis it is not so good as the Indian coal, and would not pay to export. But it would perhaps pay for local and Indian use. Further reports from the Geological Department are wanted.

THE falling-off in the supply of lithographic stone from the Bavarian quarries, and its consequent advance in price, is stimulating the search for the precious mineral. The annual value of the stone already consumed, is estimated at £ 2,000,000. It is said to be sold at profit of 800 per cent. on the cost of quarrying.

WE have to acknowledge receipt of Volume X., Part 4, of the *Records of the Geological Survey of India.* This number contains some very interesting papers, from which we select for publication Mr. Ball's report, on the "*Diamonds, Gold and Lead Ores of the Sumbulpur District*" as likely to most interest our readers.

AKYAB appears to have excellent prospects opening out to her. Large quantities of earth-oil have been recently discovered in the Borongo island, at the entrance of the harbour. Commercial Companies have already taken the matter up and are importing, pumps and gear, boring-tools, &c., which, within a month, will be in full work.

SPECIMENS of earth oil obtained by Messrs. Finlay, Fleming & Co., at Thayetmyo, are said to prove that as far as petroleum is concerned, British Burmah possess it in as good quality as America. Messrs. Finlay, Fleming & Co.. have large works in the district where the specimens were procured, and will doubtless reap ample returns for the labour and expense they have been put to in working mineral oil in the upper districts of the provinces of Burmah.

GOLD-MINING in the Wynaad seems to be looking up, thanks to the energy and perseverance of the prospectors. Sixty-two tons of Alpha stone from Wright's level in the Wynaad have produced over thirty ounces of rich gold, averaging nine penny weights per ton. Messrs P. Orr and Sons have bought the gold. Specimens of quartz are about to be forwarded to the Duke of Buckingham. The Commissioner has visited the works. A proposal to work the Alpha on an extensive scale is mooted. The capital proposed is fifteen lakhs.

MR BRYCE-WRIGHT, F. R. G. S., the eminent mineralogist, has recently made a collection of some of the largest diamonds extant. These remarkable gems have now been formed into a suite of jewels which for size and brilliancy are, perhaps, unparalleled. The set comprises a necklet of 26 brilliants weighing nearly 300 carats; a seven-brilliant "bangle" bracelet of close on 105 carats, two earrings of a single stone each weighing 47 carats, and a cross composed of seven brilliants weighing 75 carats. Thus the aggregate weight of these gigantic gems is close upon 574 carats. The "Bryce-Wright diamonds" are on view for a short period.

THE Pennsylvania Graphite Mining and Manufacturing Company are turning out some very good plumbago. The analysis as follows:—

Carbon	93·61	
Silica	2·68	4·87 earthly matter
Alumina	0·55	
Oxide of iron	0·87	
Lime	0·25	
Magnesia	0·52	
Moisture	1·35	
	99·83	

It is found in a gneiss rock and in clay, and is deemed more likely to have a future than any American plumbago yet seen. Orders for Ceylon plumbago, small though they were, are being cancelled, we hear.

Mr. Walter Ness, who is under an engagement by the Government to develop the Warora coalfields of Central India, delivered an address to the members of the Staffordshire Institute of Mining Engineers, at Dudley. He said that in the Warora coalfields there were by computation 500,000,000 tons of coal within fourteen miles. The coal consisted mainly of an 11ft. seam, but owing to the difficulty of native labour it had to be worked by the long-wall system' It took three or four natives to do the same amount of work done by one English miner. He had had some trouble in training the natives to work in the pits, and also as blacksmiths and carpenters, but afterwards they gave him little trouble, as they were very amenable to law and order. About fifty miles from where he was engaged in the development of the coal field, there was a hill with a rich vein of the ironstone and he calculated that it contained 3,000,000 tons of rich ore. He hoped that the time would soon come when the seam would be worked, and iron made in India. He said the coal was not faulty, and he had not seen any gas. There was no female labour under ground, and all the coal raised at present was used for locomotive purposes. The price was 12s. per ton, but this would be reduced when the coal could be raised by skilled workmen. Mr. Ness afterwards presented to the Institute for their museum a number of fossils and specimens of minerals, he had brought over. The former comprised parts of fresh-water turtle, Nappeau shells, coprolites, and fish, and the latter consisted of specimens of coal, coke, and iron.

The annual statement by Messrs. Wells, Fargo and Co., of precious metals produced in the States and Territories west of the Missouri River, contains some information of extreme interest. The statement covers British Columbia and the west coast of Mexico, and shows an aggregate yield of $90,875,173, In 1875 the yield was $80,889,057, and that was the greatest ever known in the history of the country. It will be seen that the increase is $9,986,136, or 12½ per cent. Of this increase $7,462,762 was in silver, while $2,583,454 only was in gold. In this connection we invite attention to the following table prepared by Messrs. Wells, Fargo and Co., showing the total product of the region covered by their reports, and its distribution between the various metals for the past six years :—

Year.	Total.	Lead. &c.	Silver.	Gold.
1871	$584,28.000	$2,100,000	$20.286,000	$35,898,000
1872	62,236,959	2,250,000	20,527,500	39,459,459
1873	72,258,693	3,450,000	28,352,100	40,456,593
1874	74,401,045	3 800,000	30,498,000	40,103,045
1875	80,889,057	5.100,000	34,043,910	41,745,147
1876	90,875,173	5,040,000	41,506.672	44,328,501

It will be noticed that while the yield of gold has advanced in six years only about 25 per cent., the yield of silver has advanced in five years fully one hundred per cent., and that the greater part of this increase took place in the year 1873 and in 1876. From 1872 to 1873 there is an advance of fully 33⅓ per cent., and last year there was another of 22 per cent. The advance in gold has, on the contrary, been comparatively steady and moderate, the greatest increase since 1872 being found last year. Messrs. Wells, Fargo and Co., estimate, after careful analysis, that of the §37,000,000 produced from the Comstock lode last year, quite 46 per cent., or §17,125,000, was in gold. Of the whole product of Nevada, 35 per cent. was gold, and of the product of the silver mines 31 per cent. was gold. This fact has a distinct bearing on the value of the Comstock lode, and on the part which its owners are playing in the legislation of the country. Of the entire product of the year, Nevada is allotted $49,280,761, and California $18,615,807."

THE SUCCESS AT THE ALPHA GOLD MINES.

The report of the "Prince of Wales Gold Prospecting Company," on its working of the "Alpha" Mine, mark an important epoch in Wynaad Gold Mining, It is a note of real success, and promises to pay. In October and November, gold up to the value of over two thousand rupees was raised from the mines, and the Directors give us to understand that this is a return of nearly cent. per cent. on the expenditure. This it must be regarded as satisfactory by the subscribers to the Working Fund, and also by the despondent shareholders of the "Alpha Company," who leased their mine to the "Prince." But we must not be elated. There is no need even after this success to apprehend the "rush" of gold-seekers which was hinted at by the *Pall Mall Gazette* in 1875. One swallow does not make a summer, and there is no gold and sufficient reason why this success should raise the hopes that have sunk very low up again to the very exalted level of July, 1874. The late crushings have yielded 11 dwts. 19 grains per ton. The original projectors proclaimed their confidence that "with proper steam machinery and appliances the stone will yield about one ounce to the ton possibly more." This was the opinion of those who had "much experience in quartz-reef mining in Australia." The history of the gold-mining enterprize in Wynaad is a humiliating one ; but withal full of lessons that may be turned to good account. Like many another promising venture the most "careful considerations" of experienced men's short sightedness and impatience threw difficulties in the way. The reefs were easily got at ; undoubtable evidence was forthcoming that they were all more or less auriferous, containing payable quantities of gold, inferior, it is true, to that of Australia, but superior to that of more civilised countries. Here were apparently all the elements of success. But no sooner were operations commenced than ill-luck set in, Nothing went right. The initial mistake was, according to some, the use of a steam instead of water-power. Water power was at hand and could easily be made available. The steam engine could not be kept at full work because of wet fuel, consequently the crushings fell much below the original estimate, of 400 tons of stone per month ; while the expenses were of course fully equal to expectations. Instead of 400 tons, a trial month's crushing, that was intended to be a sample to the public of possibilities, totalled only 260 tons of stone. The directors had fixed their minimum at five dwts. to the the ton ; but the sample crushing yielded under two dwts. An authority on gold-mining had said :—"With machinery and modern appliances, the reefs should pay even if only three dwts, of gold are got always from the ton of quartz no wonder then, that when the out-turn fell so much below the minimum paying figure, the directors were "highly dissatisfied." Yet the ill-success was not to be easily accounted for, even when full consideration was given for sick managers, bad machinery wet-fuel, and indifferent management. Between the result of assays made by professional men, and the average out-turn at the mines there was an astounding difference, not even to be explained by the surmise that especially favourable looking quartz had been forwarded to the assayist, while the stampers had to crush the stone as it came to hand. The great obstacle thrown in the path by Nature was discovered ; an enormous quantity of iron pyrites was mixed with the gold and the consequent difficulty of separating the precious metal from its base admixture was found to have led to an enormous loss. The great stubbornness of the union between the gold and iron pyrites seems to be a marked peculiarity of the Wynaad reefs, and the future depends not a little on the readiness of the means to produce easy separation. The present successful out-turn of the Prince of Wales Company from the Alpha mine, is due to the fact that the stone was burnt in a kiln the burning aiding very materially the subsequent process of separation. This is a great step in advance. By the old system, the greater part of the gold was lost, because it escaped among the refuse ; the refuse, or "tailings" from the burnt stone has been found to be peculiarly free from gold. But what is to be the future of the enterprize ? All the companies are resting on their oars ; even the Prince of Wales, which is doing something, is not paddling its own canoe. A large sum of money has been sunk ; but not uselessly, that is, if those who have embarked their funds in Wynaad gold are sufficiently alive to their own interests. By this time those most confident in their own experience, skill, and resources, must be convinced that it will never do to continue to meddle and muddle, with small sums of money and amateur mining. The European market must be appealed to by means of men thoroughly responsible and of good position, who will also be able to lay the facts that have been gathered throughout the eventful history of Wynaad gold-mining in a full and fair light before Europen capitalists.—*Neilgherry Courier.*

THE COAL AND IRON FIELDS OF INDIA.

The first systematic and extensive survey of the coal and iron fields of India was begun six years ago, and th general report submitted by Mr. Banerman in 1873 becam the basis of a minute, in which the Viceroy invited the Governments of Bengal, the North-West, Central Provinces, Punjab &c., to supply detailed information on the subject. The replies were published in August, 1874. In November they were followed by a series of extremely interesting minutes and letters from the Chief Commissioner of the Central Provinces, Mr. Hughes, of the Geological Survey, and Mr. Ness, the officer appointed by the Home Government to report on the coal, iron, and limestone of the Wardha Valley. Fresh reports are being received from time to time, and though the subject is far from being exhausted, the question of the possibility of an iron industry i alleged to be beyond dispute. The richest ores are, perhaps confined to the Wardha Valley, Central Provinces—the "Indian Black Country," as some are even now venturing to call it. Mr Hughes, of the Lahara field, in that district, described it as "on of the marvels of the Indian mineral world," while Mr. Nes described it as "one of the best non-ore fields in the world." Mr Morris, the Chief Commissioner, adds that "the existence o valuable limestone in the vicinity has also been clearly established." Mr. Ness believes the locality to be capable of producing "more suitable iron for conversion into Bessemer steel than almos any other to which that process has been applied." An enormou quantity of ore lies on the surface, and, for the rest, the Lohar iron is "practically inexhaustable." The detailed surveys subsequent to that of Mr. Banerman have finally disposed of th "flux" difficulty. Limestone "of excellent quality" and unlimitted quantity is obtainable at three leading localities, all withi two to six miles of Warora. The Warora coal is as plentiful a the iron. It was in consequence of its fitness for locomotiv consumption that the Government authorised the constructio of the Wardha Valley Railway, and Mr. Ness claims to have hi on a successful method of converting it into "patent fuel" fo his proposed Bessemer Steel Works. The chief disadvantage o Indian coal as compared with the English mineral is its friability; but Mr. Ness maintains that, with a judicious system of constructing furnaces and mixing fuel, ore, and lime, "the reduction to the metallic state may be obtained at a much less cost in plant than is at present required in England." Warora, is the southern terminus of the 46-mile branch line, the northern end of which, Wardha, stands on the Nagpore extension of the Great Indian Peninsula Railway. Situated in the very heart of India, it is thus connected by railway with every portion of its huge extent. It is also in close proximity to the cotton districts of the Central Provinces and the Berar. The cotton mart of Hingunghat stands on the Wardha line, midway between its termini; and even Bombay itself is only 18 hours distance by rail. With regard to Raneegunge the Government inspector, says there is "perhaps no area of similar size in the world which can compare with it for actual thickness of seams." Recent analyses of the Raneegunge coal show that its average of sulphur is considerably under 1 per cent. The percentage in eleven specimens of good English coal being from ·55 to 1·82, a fact, says the reporter, "which will not readily be credited by those who think that Indian coals are always saturated with iron pyrites." Eight different kinds of the Raneegunge coal are specially classed as adapted for smelting purposes, while twenty others are proved equally fit "for raising steam and for smithy works." There are about forty-four mines at work on the Raneegunge fields, but numbers of them are hardly worthy of the name being merely open quarries worked by hand labor. The better class of works employ steam-engines, of which there are about sixty. The coal is beginning to be largely consumed on the public works. The East India Railway Company buys large quantities, and Raneegunge coal was almost the sole fuel consumed by the rice-steamers employed during the famine of 1874. The ironstone of Raneegunge, says the Government surveyor, probably amounts to "200 million tons for every square mile" of the section. The Bengal Government report of 1875 claimed for this district a rank at least as high as that of the Wardha Valley. The reports state that abundance of the indispensable limestone is procurable in the Bengalee "Black Country" likewise. In 1875 the "Bengal Iron Works" were started on the Raneegunge field; but as yet the iron industry of India has hardly attained to the stage which the Bombay cotton manufacture reached twenty years ago.

ON THE DIAMONDS, GOLD AND LEAD ORES,

OF THE SAMBALPUR DISTRICT, BY V. BALL, M.A. F.G.S.

Geological Survey of India.

DIAMONDS.

WHEN, or by whom, diamonds were first discovered in Sambalpur is quite unknown. As in similar cases in many other parts of the old world, an impenetrable haze shrouds the ancient discoverers from our view, Such evidence as exists tends to the belief, that the search for diamonds was carried on, under a rude system, for many centuries before the year 1850, when the the British took possession of the district from the late Rajah, Narain Sing.

So far as I have been able to ascertain, the first published notice of the subject is to be found in the narrative of a journey to Sambalpur, which was undertaken by Mr. Motte in the year 1766. The object of this journey was to initiate a regular trade in diamonds with Sambalpur, Lord Clive being desirous of employing them as a convenient means for remitting money to England. His attention had been drawn to Sambalpur by the fact that the Rajah had a few months previously sent a messenger with a rough diamond, weighing 16½ carats, as a sample, together with an invitation to the Governor to depute a trustworthy person to purchase diamonds regularly. The Governor proposed to Mr. Motte to make the speculation a joint concern, in which writes the latter: "I was to hold a third; he the other two: all the expenses to be borne by the concern. The proposal dazzled me, and I caught at it, without reflecting on the difficulties of the march, or on the barbarity of the country, &c."

In spite of his life being several times in danger from attacks by the natives, the loss of some of his followers by fever, and a varied chapter of other disasters, Mr. Motte was enabled to collect a considerable amount of interesting information about the country. Owing to the disturbed state of Sambalpur town, however, he was only able to purchase a few diamonds. After much prolonged negotiation, he was permitted to visit the junction of the rivers Hebe, (Ebe), and Mahanadi where the diamonds were said to be found. A servant of the Rajah's who was in charge there informed him that "it was his business to search in the River Hebe, after the rains, for red earth, washed down from the mountains, in which earth diamonds were always found I asked him if it would not be better to go to the mountains and dig for that earth. He answered, that it had been done, until the Maharattas extracted a tribute from the country; and to do so now would only increase that tribute. He showed me several heaps of the red earth—some pieces, of the size of small pebbles, and so on, till it resembles coarse brick-dust—which had been washed, and the diamonds taken out."[*]

The next of Sambalpur diamonds is to be found in Lieutenant Kittoe's account[†] of his journey, in the year 1838, through the forests of Orissa. He speaks of the people as being too apathetic and indolent to search for diamonds. His remarks on the localities where they occur seem to be derived from Mr. Motte's account, to which, indeed, he refers.

Although published in the same number of the Asiatic Society's Journal,[‡] we find a paper dated two years later, or in 1840 which was written by Major Ousely, on the *Process of washing for gold-dust and diamonds at Heera Khoond*." In this we meet the following statement: "The Heera Khoond is that part of the river which runs south of the islands. The diamonds and gold-dust are said to be washed down the Ebe river, about four miles above the Heera Khoond; but as both are procurable as far as Sonpore, I am inclined to think there may be veins of gold along the Mahanadi."

No mention is made by Major Ousely of the system of throwing a *bund* across one of the channels, as is described further on; but from my enquiries, I gathered that that method of washing was in practice for many years before the period of Major Ousely's visit. He describes the operations of individual washers—not the combined efforts of the large number, which made that washing successful.

The diamonds found became the property of the Rajah, while the gold was the perquisite of the washers, who sold it for from twelve to fifteen rupees per *tola*.

In the *Central Provinces Gazetteer* it is stated that "during the period of native rule some fifteen or twenty villages were granted rent free to a class called *Jharas*, in consideration of their undertaking the search for diamonds. When the country lapsed in 1850, these villages were resumed." So far as can be gathered from the various sources of information, large and valuable diamonds have been occasionally met with; but the evidence on this point is somewhat conflicting. I do not think, however, that what we know is altogether consistent with the statement in the *Gazetteer*, that "the best stones ever found here were thin and flat, with flaws, in them."

Local tradition speaks of one large diamond, which was found during the Maharatta occupation. Its size made its discovery too notorious; otherwise it would in all probability, like many other smaller ones, found at that time, never have reached the hands of the Maharatta agent. It is said to have weighed two *tolas* and and two *mashas* (at ten *mashas* to the tola),[*] which would be about 316·2 grains troy, or expressed in carats 99·3. It would be impossible, of course, to make any estimate of the value of a rough stone of this size, regarding the purity, colour, &c., of which nothing is known.

Another diamond, in the possession of Narain Singh, is said to have weighed about a *tola* the equivalent of which, calculated as above, would be 45 35 carats. Already one of 16·5 carats has been mentioned as having been sent to Calcutta in 1766. One large but slightly flawed diamond, which I saw in the possession of a native in Sambalpur, was valued in Calcutta, after cutting, at Rs. 2,500. Mr. Emanuel, in his work on Diamonds and Precious Stones, give some particulars regarding the diamonds of Sambalpur, but the limited information at his disposal does not appear to have been very accurate. He records one diamond of 84 grains having been found within the period of British rule, but does not mention his authority. There are said to be a good many diamonds still in the hands of the wealthier natives in Sambalpur. Of course, large diamonds such as those above mentioned were of exceptional occurrence; those ordinarily found are said to have weighed however, 2 to 4 *ruttees*, equal on an average say to the thirteenth part of a *tola* or 4 7 grains equal to 1·48 carats. In the Geological Museum, there is at present a diamond which was sent to the Asiatic Society from Sambalpur by Major Ousely. It weighs only 85 5 grs. equal to 26 carats.

As usual, I believe, in all parts of India, the diamonds were classed as follows:—

I.—*Brahman*.—White, pure water.
II.—*Kshatrya*.—Rose or reddish.
III.—*Vaisya*.—Smoky.
IV.—*Sudra*.—Dark and impure.

From personal enquiry from the oldest of the Jharas, or washers at the village of Jhunan, and from various other sources, I have gathered the following details as to the manner in which the operation were carried on in the Rajah's time:—

In the centre of the Mahanadi, near Jhunan, there is an island, called Hira Khund,[†] which is about four miles long, and for that distance separates the waters of the river into two channels.

In each year, about the beginning of March or even later, when other work was slack and the level of the water was approaching its lowest, a large number of people,—according to some of my informants, as many as five thousand,—assembled and as the result of a considerable amount of labor, threw a *bund* across the mouth of the northern channel, its share of water being thus deflected into the southern. In the stagnant pools left in the former, sufficient water remained to enable the washers to wash the gravel accumulated between the rocks, in their rude wooden trays and cradles.

Upon women seems to have fallen the chief burden of the actual washing, while the men collected the stuff. The implements employed and the method of washing were similar to those commonly adopted in gold-washing, save only that the finer gravel was not thrown away until it had been thoroughly searched for diamonds. Whatever gold was found became the property of the washer, as already stated. Those who were so fortunate as to find a valuable stone were rewarded by being given a village. According to some accounts, the washers, generally, held their villages and lands rent-free; but I think it most unlikely that all who were engaged in the operation should have done so.

So far as I could gather, the people did not regard their, in a manner enforced services, as involving any great hardship; they gave me to understand that they would be glad to see the annual search re-established on the old terms. Indeed, it is barely possible to conceive the condition of the *Jharas* having been at any time worse than it is at present. No doubt the gambling element, which may be said to have been ever present in work of the above nature, commended it to the native mind.

According to Mr. Emanuel, these people show traces of Negro blood and hence it has been concluded that they are the "descendants of slaves imported by one of the Conquerors of India." They are, however

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[*] This description suggests laterite as the matrix from which the diamonds were proximately derived. In this connection it may be noted that one of the principal sources of Cape diamonds is said to be a superficial ferruginous conglomerate.

[†] J. A. S. B., VIII, 1839, p. 875.

[‡] *Ibid.* p. 1051.

[*] (One masha-14·37 grains troy): properly speaking there are 12 mashas in a standard tola.

[†] Lit., Diamond mine.

I should say, an aboriginal tribe, showing neither in their complexions, character of their features, nor hair, the slightest traces of a Negro origin.

When Sambalpur was taken over in 1850, the Government offered to lease out the right to seek for diamonds. And in 1856 a notification appeared in the *Gazette* describing the prospect in somewhat glowing terms. For a short time the lease was held by a European at the very low rate of two hundred rupees per annum; but as it was given up voluntarily, it may be concluded that the farmer did not make it pay. The facts that the Government resumed possession of the rent-free villages, and that the Rajah's operations were carried on without any original outlay, materially altered the case, and rendered the employment of a considerable amount of capital then, as it would be now, an absolute necessity.

Within the past few years, statements have gone the round of the Indian papers to the effect that diamonds are occasionally found now by the gold-washers of Sambalpur. All my enquiries failed to elicit a single authentic case, and the gold-washer I spoke to and saw at work assured me that the statements were incorrect. Moreover, they did not appear to expect to find any, as I did not observe that they even examined the gravel when washing.

With regard to the orgin of the diamands, the geological structure of the country leaves but little room for doubt as to the source from whence they are derived. Coincident with their occurence is that of a group of rocks which has been shown to be referable to the Vindhyan series, certain members of which series are found in the vicinity of all the known diamond-yielding localities in India,* and, in the cases of actual rock workings, are found to constitute the original matrix of the gems.

In several of the previous accounts, the belief is either stated or implied that the diamonds are brought into the Mahanadi by its large tributary the Ebe. It would not, of course, help the point I am endeavouring to establish to say that the Ebe, at least within our area, is not, except indirectly,† fed by waters which pass over Vindhyan rocks, but I have the positive assurance of the natives that diamonds have not been found in that river, although gold is and has been regularly washed for. On the other hand, diamonds have been found in the bed of the Mahanadi, as far as west Chanderpur and at other intermediate places, well within the area which is exclusively occupied by the quartzites, shales, and limestones of Vindhyan age.

The mere fact that the place Hira Khund, where the diamonds were washed, is on metamorphic rocks, may be readily explained by the physical features of the ground. The rocky nature of the bed there and the double channel caused by the island afforded unusual facilities for, in the first place, the retention of the diamonds brought down by the river; and secondly, for the operations by which the bed could on one side be laid bare and the gravel washed by the simple contrivances known to the natives.

It is impossible to say at present which the actual bed or beds may be from whence the diamonds have been derived, as there is no record or appearance of the rock ever having been worked; but from the general lithological resemblance of the sandstones and shales of the Barapahar hills and the outlier at Borla with the diamond-bearing beds and their associates at Panna in Bundilkhand and Banaganpilli in Karnul, I have very little hesitation in pointing to these rocks as in all probability including the matrix. Above Padampur the Mahanadi runs through rocks of this age, and I should therefore strongly urge upon any one who may hereafter embark upon the undertaking of searching for diamonds in Sambalpur to confine his operations, in the first instance, to the streams and small rivers which rise in the Barapahar hills and join the Mahanadi on the south. Besides the obvious advantage of being, as I believe would be found to be the case, close to the matrix, these streams would, I think, be found to contain facilities for obtaining a sufficient head of water for washing purposes. The works would require but a few laborers, and could be carried on for a much longer period every year, say for eight or nine months, than would be possible in the case of the washings in the bed of the Mahanadi itself.

According to the accounts received by me, the southern channel of the Mahanadi used not to be emptied in the Rajah's time; but from various causes I should expect it to yield, proportionally, a larger number of diamonds than the northern. In the first place, the stronger current in it would be more efficient in removing the substances of less specific gravity than diamonds, while the rocks and deep holes in it afford admirable means for the retention of the latter. Again, it is in direct contract with the sandstones and shales (presumedly diamond-bearing) of the outlying ridge at Borla. Owing to the greater body of water to be dealt with, it would be found to be more difficult to divert than that which flows in the northern channel; but the result in a greater harvest of diamonds would probably far more than compensate for the greater expenditure incurred.

In the country to the south of Sambalpur, in Karial and Nowagarh, where rocks of similar age occur to those of the Barapahar hills, I failed to find any traditional record of diamonds having ever been found or searched for. It is just possible, however, that the names of several villages in which the word *Hira* (diamond) occurs may have reference to some long-forgotten discovery.

In addition to diamonds, pebbles of Beryl, Topaz, Carbuncle, Amethyst, Cornelian, and clear quartz used to be collected in the Mahanadi; but I have not seen either sapphires or rubies. It is probable that the matrix of these, or most of them, exists in the metamorphic rocks, and is therefore distinct from that of the diamonds.

GOLD.

In all probability gold occurs pretty generally throughout those portions of the district in which metamorphic rocks prevail. So far as I have been able to gather from personal observation, the washers confine themselves to the beds of the Mahanadi and Ebe; but in the rains they are said to leave the larger rivers and wash in the small jungle-streams.

In the Ebe, below Tahood, I saw a party of gold-washers encamped on the sand. The places where they were actually washing were within the area occupied by rocks of Talchir age; but whether the gold was proximately derived from the Talchirs or had been brought down by the river, as is possible, from the metamorphic rocks, a short distance higher up, I am unable to say.

There is of course no *prima facie* improbability in the Talchir rocks containing gold. On the contrary, the boulder bed, including, as it does, such a large proportion of materials directly derived from the metamorphic rocks, might naturally be expected to contain gold. In the original description of the Talchir coal-field the following passage occurs:—"Gold is occasionally washed in the Tikaria River, and was also a few years since obtained from the sands of the Ouli." The latter case is rather interesting, since the localities are in a sandstone country, through which the Ouli mainly flows.* In this connection it may be mentioned that in Australia, quite recently, a conglomerate bed of carboniferous age has been found to be auriferous.†

As to the methods employed by, and the earnings of the gold-washers, the remarks made in a paper by me on the gold of Singbhum ‡ apply equally to Sambalpur, and need not be repeated here.

LEAD ORES.

Galena at Jhunan.—On the occasion of my first visit to Sambalpur in 1874, Captain Bowie, at that time Deputy Commissioner of the district, showed me some specimens of galena which had remained in the possession of the Tehsildar and other residents before the occupation of the district in 1850. The history of this galena appeared to be as follows:—

It was discovered in the bed of the Mahanadi at Jhunan, 10 miles west of Sambalpur, in the Rajah's times, and was at first extracted to a small extent by the people and used as a substitute for *surma* or antimony for anointing the eyes. Suddenly, however, the Rajah, Narain Singh, becoming afraid that the discovery might attract the notice of Europeans, ordered the excavation to be stopped and the lode to be covered up and concealed.

During the 25 years or so which had elapsed since that time, the river has somewhat shifted its channel, and sand and clay had been deposited against the bank where, according to the villager's recollection the lode was originally exposed. By Captain Bowie's orders, a party of these villagers were set to re-discover the positon, and on the 27th December we visited the spot and found that several trenches had been dug in the sand; these, owing to the influx of water and a shifting layer of quicksand, had failed to lay bare the face of rock, but from the fragments of stone brought up it was apparent that the lode had not been struck. The rocks seen in the bed of the river consist chiefly of a coarse granular-looking granitic gneiss, which strikes from about north-west to south-east. Observing some small veins of quartz to run with the strike, it seemed probable that the lode would do so too, and I accordingly laid out a line for a new trench, which resulted a few days later in the re-discovery of the deposit.

Among the first specimens of galena brought into Sambalpur was one weighing 1 maund 6 seers 4 chittacks, of which about one-half consisted of galena, the remainder being made up of portions of the quartz gangue and sides of the lode.§ In some of these first specimens, the presence of antimony was apparent, and there were also traces of the carbonates of copper. On re-visiting the locality, I was able to satisfy myself that the deposit occurred as a true lode which, though striking apparently with the surrounding granitic gneiss rocks, has a different underlie, and cuts across the plains of their bedding and foliation. At this stage, what I subsequently found to be the case was not apparent, *viz.* that the lode does not rise to the surface or outcrop of the gneiss above the bed of the river, but that it commences somewhat abruptly several feet below. In the portion of the lode exposed, which was about six feet in length, the distance between the walls varied from 16 to 19 inches. The strike was from 35° north-of-west to 35° to south-of-east with an underlie of 45° to 35° east-of-north, that of the surrounding rocks being in places 60°.

The gangue consists of quartz, which is permeated in every direction by nests and strings of galena. In places massive ore stretches from wall to wall. Besides hydrated peroxide of iron which forms a kind of *gossan* with the quartz, I found no trace of any foreign minerals in the gangue.

On assay, the galena yielded 11 oz. 5 dwts. of silver to the ton of lead. This, though a small precentage, would be sufficient under favorable circumstances to yield a profit on the cost of extraction.

On the whole, the aspect of the lode, as seen at that time in the bank of the river, was so promising that, at Captain Bowie's request, I laid out a system of trenches by which its extension inland from the river might be proved. Subsequently, a small grant of money was made by the Central Provinces Government for the purpose of making some experimental excavation, and operations were forthwith commenced. Just before leaving Sambalpur in April 1875, I again visited the locality to see what progress had been made. I found that a trench about 20 feet deep had been dug through the alluvium some 60 yards from the bank of the river; but it had not been carried to a sufficient depth to lay bare the rock throughout. On this occasion I first found out what I have above noticed, namely, that the lode does not, on the scarped river face, rise to the outcrop of the rock. This, of course renders the chance of striking it by mere superficial trenches in the rock very much smaller than it would otherwise be.

In the absence of any one who could take charge of the work on the spot, I did not recommend any operations in the river bed itself, as, if injudiciously carried out, they would not improbably injure the prospects of successful mining hereafter by destroying all trace of the lode and leaving in its place an excavation open to the floods. Such work as had been done was, from the want of skilled guidance, not of a conclusive character. I therefore could not recommend any further outlay being incurred on the exploration, and accordingly nothing more has been done in the matter since 1875."

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* Conf. Medlicott, Bundelkund, Mem. G. S. I., Vol. II, p. 65.
* Mallet, Vindhyan series, *id.*, Vol. VII, p. 69.
* King, Kadapah and Karnul formations, *id.*, Vol. VIII, p 87.

† By a few small streams which rise in an isolated outlying hill called Gotwaki. It should be stated, however, that one of the tributaries of the Ebe, the Ioha, far away in Gangpur, is said to produce diamonds; but the statement needs confirmation and the geology of that part of the country is at present quite unknown. Near its sources, far away in Chota Nagpur, I have heard the Ebe spoken of as the Hira Nad.

* Mem., G. S. I. Vol. 1, p. 85.

† *Vide* Geol. Mag. 1877, p. 330.

‡ Records, Vol. II. p. 11.

§ This fine sample is now in the Geological Museum.

Galena at Padampur.—The above is not the only locality in Sambalpur where galena has been found. Twenty-four miles farther up the Mahanadi, in the bed of the river under the village of Padampur, strings and small nests of galena occur somewhat irregularly in a bed of Vinhyan limestones. This deposit does not appear to exist in sufficient abundance to become of any economic importance.

To the north of Sambalpur, near Talpuchia on the Ebe, some rolled pebbles, consisting of a mixture of the oxide and carbonate of lead, have been found. Whence they were originally derived is uncertain, but I think it possible that the matrix may exist in a small hill to the north of Talpuchia, which consists of fault-rock and *gossan*.

The Planters' Gazette.

TEA.

TEA GARDEN EXPENDITURE.

(To the Editor of the Englishman.)

SIR,—The competition of the past few years for local labour has served to increase the coolie's remuneration in three distinct forms.—(1) Decrease of the daily task; (2) increase of bonus for coming under or renewing agreements and (3) actual advance of monthly wage. In former days, 30 *nulls* (of 12ft, sqr. each) was the ordinary task for hoeing of a fair depth deeper than what is now called "light hoeing." On visiting Central and Upper Assam in September last, I found that few gardens obtained less than 20 or more than 25 *nulls* for what certainly was no better work than that of the old 30 *null* task. The average may be taken at probably 22 *nulls* throughout Assam. As the coolies are paid for whatever extra work they do, this represents a practical increase to their wage of 26·66 per cent. I have seen many coolies returning from the completion of their full day's task of hoeing by 9 or 10 o'clock in the morning, whilst at one garden I visited, it is the *habit* to get double work (of course for double pay) out of nearly all the coolies on the garden. Hoeing I take for illustration, it forming so important a feature in the work in the garden; and so far as the task goes it is fairly representative of the other operations, all having been subject to similar reduction. The instances cited are given to shew that the coolies could perform much more work than they at present do.

Bonuses may be said to have increased in round figures 50 per cent. during the past few years. In some gardens it is a great deal more, whilst on others more favourably situated it is less.

The advance of wages has been confined to certain districts in Assam, so far as I know. It is from Rs. 5 per month, the former rate, to Rs. 6 for men, and from Rs. 4 to Rs 5 for women. Allowing that two-thirds of the labourers are men, this represents an advance of 21 14 per cent.

The pay of a coolie at present on a garden in Assam where the higher rate has been found necessary is	Rs.	6	0	0
His bonus may be taken on the average at Rs. 15 per annum or say per month	,,	1	4	0
With the present low scale of work to be performed, there is no difficulty in his obtaining additional half pay or say	,,	3	0	0
Total wage per month ...	,,	10	4	0

In addition to which he has a hut built for him; rice supplied at not more than Rs. 3 per maund—whatever it may cost the garden—a blanket; grazing ground for cattle; vegetable seeds if he will take them; medical attendance and a holiday once a week.

So long as tea paid large profits, it was possible to submit to this high expenditure. *Now*, however, their are not only low prices but every prospect of their continuing until consumption shall have overtaken the great increase of production. This must be a matter of years. It appears to me therefore to be the fitting time for a combined effort being made to reduce local cost to at least its former level or say about 25 per cent. below what it now is. This would still leave the coolie a (for him) handsome income, and by reducing local expenditure from say Rs. 40 per maund of tea made to Rs. 30 would give the proprietor Rs. 10 a maund of profit, where in many cases he has at present none. Reduction of bonus and increase of task are easily capable of being overtaken if the planters of each district would only combine to do so. As extensions have been greatly checked by the gloomy prospects, and the competition for labour correspondingly lessened, the suitableness of the present time for initiating a reduction of cost without any reduction in efficiency of work, seems very apparent.

Owing to the difference in situation, healthfulness, &c, of the various tea gardens, different rates of bonus, wages and task are to be found, and would have to continue. But without attempting to equalize these where the conditions are unequal, it would surely be possible in each district to arrange a scale by which the incidence of the reductions would fall proportionately.

I do not touch upon the subject of cost of importing coolies, which, however, is one of hardly less importance, and urgently calls for being dealth with.

Calcutta 13th December 1877. MATT, DREWS,

THE Commissary General has accepted the tender of Messrs. Aspinwall & Co., for 118,618 lbs. of Indian or China tea, to be delivered on or before the 1st day of April next at the Commissariat Stores at Madras, at 9 as. 3 p. per lb. The rate in 1875-76 was 11 as. 3 p.; in 1876-77, 10 as. 6 p.; and in 1877-78, 10 as. 7 p. per lb.

THE ultimate commercial success of tea growing in Ceylon, is seriously questioned from the fact of the flushes not being sufficiently frequent to give a yield, large enough to pay. The Ceylon tea gardens, which, for some years, have been supplying the local market, cannot but have done well, selling their produce as they do at a rupee and a half a pound, but it will be a different matter when the Ceylon tea consumption is more than overtaken, and the balance forced to compete at home, with China and Indian grown teas.

IF we can trust accounts of planting in Japan, we may hope to see an improved quality of tea turned out in our old Tea gardens 10 or 15 years hence. The full life of a tea bush is from twenty to thirty years, and it is stated to be the practice in Japan that when it has reached this age, it is cut down to the stump, and then shoots spring up again, and in three or four years are ready for picking. This second life of the tree is much better than the first, both in flavour and size of production, but, after it has run out, they are obliged to dig it up and re-plant from seeds."

TEA cultivation in Travancore seems to make very slight progress, though the Travancore Hills are eminently adapted to the culture of tea, and the few experiments which have been essayed there have turned out very successful. Tea manufactured in the Government Tea Garden at Peemade, Travancore, fetched in the London Market 1*s.* 8*d.* to 1*s.* 10*d.* per lb., while in Russia it fetched 2*s.* per lb. The Travancore Government has, we believe, from time to time, made attempts to induce capitalists to invest in tea-cultivation in Travancore, but somehow without success.

WE understand that a number of Ceylon planters are about to form a Joint Stock Company, for tea cultivation on a large scale in the most promising district in the island, Saffragam. They have every confidence in the climatic conditions of the district as favourable for the development of frequent flushes of leaf, which is a primary consideration, and there will be the great advantage of Singhalese labour and facilities for conveyance to Colombo by land or water. It is confidently anticipated that the company may soon be afloat; a fine block of 1,000 acres is in prospect, and already there is an extensive nursery of strong healthy plants above ground ready by the time the jungle is burnt off.

WE quote the *Darjeeling News*:—A batch of Darjeeling tea was recently sold in Mincing-lane and fetched 7*s.* and 7*s.* 6*d.* per pound,—exactly double what it realised in the Calcutta market. This is only another instance of the unfair way Darjeeling teas have been treated in the Calcutta market this year. We understand that a considerable number of Darjeeling producers have made up their minds to send their teas home direct next season. This, we think, is a step in the right direction, as the teas are sure of fairer treatment in a large market like Mincing-lane, than they are likely to receive in such a limited one as Calcutta. By sending the tea home direct, the very exorbitant Calcutta charges will be saved, and we know of a most respectable London firm who has agreed to sell tea and buy stores for one per cent. commission."

REVIEWING the progress of tea cultivation in Southern India, the *Madras Times* says:—The Government did start a tea garden or two and imported "skilled manufacturers" from the North-West Provinces, but the experiment proved a failure, to the confusion of a Government which was so patronising in its tone. One or two companies were started, notably the Neilgherry Tea Company, who among other estates owned the "Vellanie," as fine a piece of ground for tea planting as we have ever seen in India. This Company also tried "skilled manufacturers" from the North, but without success. The Company, we believe, sold their estates, and Vellanie was brought up by Mr. Tom Stanes, who has re-christened it the "Glendale." The "Glendale" tea is about the finest Neilgherry tea exported to Europe, and commands a ready sale and high price, in the Home Market. It has been remarked of late that tea cultivated and manipulated by men who have not had the supposed advantage of a professional training in Assam or China, but who have had the opportunity of testing the variations of treatment required, owing to the difference in climate, soil, &c., has been more appreciated, and fetched higher prices, in the London market, than leaf manipulated by men of long experience from Assam and Cachar. Neilgherry teas are now gaining great favour in the London Market, and the demand for them is increasing.

AN Australian farmer, Mr. Godfrey, who, attracted by favourable reports of the prospects of tea planting in the Neilgherries, had visited the Madras Presidency writes as follows to the *Australasian* "I was not favourably impressed with the life, or the paying part of the business. To plant tea or coffee successfully a man would have to take up his residence in a climate utterly inferior to anything in the colonies; and if he went in for new land, the chances are that speculative natives would combine and outbid him, and continue to do so for a considerable period of his existence. Then, again, the Indian Government throw numerous obstructions in the way of intending settlers; as far as I can understand, they don't want them and don't encourage them. They will not part with the good jungle land, the only class of land suitable for tea and coffee. Cinchona will flourish on grass land certainly, but will it pay a man to plant and wait six years for returns, when by farming in Australia or new Zealand, he can at any rate, make his acres produce something the first year? I saw a paragraph in a Madras paper, lamenting the exodus of settlers from the Neilgherry Hills to New Zealand, and the short time I was there I met two *successful* coffee planters, who had made up their minds to go to the Colonies and invest in station property."

We make no comments. Our neglect has sent many energetic men and many fortunes out of the country, which otherwise would have contributed to the development of the resources of the country.

WE publish the following statistics showing the rise of the tea trade during the last four years. The figures refer only to the China and Indian tea trade, the exports from Java are not included. The imports of tea into the United Kingdom stated in our November issue to have been in 1875, 158,060,126 lbs. are the imports during 1873, which our readers will be good enough to correct, it being a typical error in the London Trade Reports.

Export of tea from China and Japan to Great Britain.

Messrs. Olyphant & Co.'s Circular of 15*th June* 1877.

Grand Total	Season	1873-74	137,378,051	lbs.
Do.	„	1874-75	158,488,092	„
Do.	„	1875-76	155,445,448	„
Do.	„	1876-77	166,739,238	„

Export of tea from India to Great Britain

Messrs. Toulmin & Co.'s Circular of 18*th May* 1877.

Grand Total	Season	1873-74	18,400,000	lbs.
Do.	„	1874-75.	17,400,000	„
Do.	„	1875-76	25,600,000	„
Do.	„	1876-77	29,100,000	„

Consumption in Great Britain of Indian tea.

Messrs. Travers & Co.'s Annual Tea Circular for 1876.

Grand Total	Year	1874	21	Millions lbs.	= 15 per cent.
Do.	„	1875	24	„	= 17½ „
Do.	„	1876	27	„	= 19 „
Grand estimated Total		1877	32	„	

The total consumption of Tea in Great Britain is steadily increasing but not in such a great ratio as the consumption on the continent, the exports from the United Kingdom to the continent having been in the year 1875, 24,725,571lbs., in 1876, 28,017,703lbs. and it is estimated that in 1877 they will have reached a grand total of 35. millions, the quantity exported for the first 10 months having already been 28,940,798lbs.

MESSRS. BALMER, LAWRIE AND Co., in their *Tea Report* of the 7th ultimo, announce that they will not issue another report till next May. From the report before us we take over the following:—

"The past season has been marked by very exceptional weather throughout, to which, we believe is due in many cases the disappointing character of the produce that has reached this market. In consequence of the large supply of medium and common graded, prices for these descriptions have shown a very regular and steady fall, which, according to the latest accounts from London, seems likely to continue. On the other hand, the quantity of tea with point and quality has been so small, that those grades have held their own, and have been fetching proportionately higher rates. On the whole, the market throughout the year has been against the producer, and if next year's estimates should be larger than those framed for this season, no improvement can be looked for in the meantime. On the other hand, the low prices now current, have stimulated the consumption in England, October and November showing each 2,900,000lbs. taken by the trade, as against 2,400,000 and 2,500,000 for the same two months respectively last year. This increase in the consumption, combined with the fact that few extensions of cultivation are contemplated, should in due course restore the market to a satisfactory position."

A CORRESPONDENT to the *Pioneer* writes from the Kangra Valley:—It is popularly supposed that Greenland's mountains are icy. Ours are the same, for the snow lies thick upon them now, and the inhabitants of this happy valley find a chilliness in the evening zephyr, which is quite compatible with the fact, that it circulates round the snowy ramparts which form a thing of beauty and our joy for ever.

The days are very short now, and the coolies are only about 9 hours in the field, engaged at this season in hoeing and pruning. The Holtas Co.'s estate has given up the contract system by which they have been working it lately and taken to the ordinary method of engaging monthly labour. Tea-making by contract is very much the same as shoeing an army by contract in the time of war—the tea turns out badly and the soles of the boots won't stand the roads. And who is to blame? The contractor, who is perhaps the father of a large family? His paternal inclinations and his public convictions clash and he straightway posts another order for brown paper. The *gadis*, with their flocks of goats and sheep, are filling the valley again, and wending their way down to the winter pastures below. They travel from place to place, and so highly valued is their sheep manure, that not only is free right to graze in the fields given to them, but they are also paid *batta* by the Zemindars. Of late years, too, they have had the run of the tea gardens, and a seer of rice is given to each man for every night they fold their flocks on an estate. Manure is becoming very expensive owing to the great demand for it in some places, the *nerick* being as high as a rupee for sixteen baskets. Every estate near the high road has its own *serai*, where the *libynas* and carts passing down the road are courteously invited to free entertainment for man and beast. Where competition runs high, they are also alloted grazing land, and not unfrequently grass is given them. In a season like this, grass is gold—that is, metaphorically speaking—but manure means rupees, and that is literal truth. The Bundla estate has a *pucka serai* at Palampur, whose architectural beauty is only qualled by the immense advantage it confers on the Company's garden.

TEA SORTING IN THE KANGRA VALLEY.

A CORRESPONDENT writes to the *Pioneer.*—Despite assertions to the contrary, there is no doubt that year by year there is an increasing difficulty in getting men (as opposed to boys) for the heavy cultivation on the estates, which employ two classes of labourers—tea-makers at 5 rupees a month, and coolies, boys and men, at from Rs. 3 to 4; but frequently even boys draw the higher rate, and consequently the men who do not get into the tea-maker's gangs prefer to retire to the *otium cum dignitate* of home, sweet home, and send their Josephs and Benjamins out to service. A great deal naturally depends upon the *dustoor* and system of work in the various gardens. Natives don't mind staying on the estates where the "screw" is not put on, provided they get their pay tolerably punctually; but the manager who works his men up to the mark, and personally superintends and checks their work, will find his deep winter cultivation a "hard row to hoe" this year.

Most, if not all of the tea sorting in the larger tea districts of India is done by machinery, and mechanical aid is introduced a great deal more into the tea factory than is the custom here. To such of your readers as are uninitiated, it may appear wonderful that every leaf of the tea they drink individually passes twice through the hands of the boys and women employed, first in plucking it, and later on in sorting it. In the latter process 2lbs. of tea is given out to the sorters, who receive it on a round papered tray, and then. little by little, pick out the various qualities of leaf—Bohea, Congou, and sometimes Souchong. Boys especially are experts in this branch of tea manufacture, and their nimble fingers become mere machines in time. Some of the cleverest can sort from 10 to 15lbs. of *fine* tea in a day, while others will fail to do more than 2 or 3lbs., the average being from 4 to 5lbs. When the manufacturing season is over, and 80, 000lbs. of tea have to be sorted, packed and despatched (without the aid of machinery) in November and December, the magnitude of the task will become apparent. Then if you have to take your bigger and most experienced boys away from your sorting, and put them on to your cultivation in the sad deficiency of able-bodied men, you will begin to experience an idea that the more isn't always the merrier, and look back with a sad longing to the balmy days when the tea gardens were few and far between, and natives to work them as plentiful as black berries.

TEA PLANTING.

MANURING.

OUR esteemed correspondent "Mac" writes us on the above subject:—

In a former portion of this paper *viz., on Cultivation* I have spoken off deep hoeing as being better than manuring, but what about deep hoeing *and* manuring as well? This seems to be the object sought for.

I have tried all classes of manures, cow-dung, birds'-dung, patent manures, and oil-cake and the result tells me the best is the common comfort of the farmyard, principally composed as it is of cow-dung. To be brief the results I arrived at were as follows:—

Patent manures:—Expensive, effects transient, and to secure continued good crop, more has to be used than the out-turn warrants.

Birds'-dung:—Too strong, burns up the plants.

Oil-cake :—Acts very quickly but is transient in effects.

Cow-dung :—Has more effect in second and subsequent years, can be renewed yearly at small cost, and is the manure of all others to which coolies do not object.

Two ways present themselves of procuring cow-dung : 1st keeping cattle and 2nd purchasing. In some districts purchasing can be effected easily, but generally speaking if cow-dug be wanted—cattle must be kept. I have ascertained,—and will give data later on—that three head of cattle will be required per acre to allow of a liberal manuring—now in a garden of 100 acres the outlay would be :—

300 head of cattle say	Rs.	4,500
Interest 1 year at 12 per cent.	„	540
3 *Gowalas*	„	180
Medicine, &c., say	„	50
Total	Rs.	770

Say per acre Rs. 8, and this will be found to be cheaper than buying manure, as the cattle at any time are worth what they cost, and will very quickly increase in numbers, with comparatively no extra cost to the planter.

Some give 12 to 16 seers per bush every third year. I strongly recommend, and have based this estimate on giving 10 seers every year.

An old and eccentric planter of this district made sundry observations as to the quantity of manure to be obtained from one cow, and he arrived at the fact that each animal will account for seventeen seers per day. This with straw and other refuse may be calculated to produce 225 mds. per cow per annum, or 675 mds. as per above calculation, if three count to each acre. This latter quantity divided among the bushes in an acre say 2,700, gives 10 seers per bush.

As to style and time of applying, I follow this plan. I prune immediately plucking is over, and give the garden a hoeing to the depth of 18 inches, burying the prunings in the course of hoeing, about the month of February I commence a second heavy hoeing, say 12 inches, and immediately behind this latter gang the manurers are set to work, one set of men open up the earth round the bushes, the women and boys bring the manure from the walks to which it has been brought in carts, and a second set of coolies come behind and cover it in. The object I have in view is to avoid having the manure exposed to the great heat that prevails just before the rains commence. Immediately after it is spread the periodical rains set in, and it is at once carried down to the roots.

A deal has lately been written about using human ordure in tea gardens—doubtless the eminent chemist who takes a leading part in the discussion is correct regarding its virtues as a manurial agent, but the invincible repugnance evinced by coolies to its use, puts it entirely out of the range of discussion.

In preparing pits of cow-dung manure, I recommend them to be of any desired length, but not more than 10 feet deep and 20 feet wide, this for convenience of emptying, it may be noted that in such a manure pit, having a cross section of 200 feet, each 6 feet in length will contain about 680 mds. which is the quantity needed for each acre.

Where funds are available these pits should be *pucka*, and should be roofed with thatch—once a week the cow sheds are cleaned out and fresh straw supplied. Fresh straw or grass is usually to be had for the cutting in most gardens, and to this is added dead leaves and old weeds of all sorts collected by boys at spare moments.

Now what will the effects of this manuring be I feel safe in estimating the increase at 25 per cent., I mean the increase in leaf. The cost of manuring will be something like this :—

To cost of manure per acre	Rs.	8
To labour &c, ...	„	12
Total	Rs.	20
Estimated excess tea 100lb., at 12 annas	Rs.	75
Clear profit per acre each year	„	55

I have taken care not to under-estimate the cost of manure on the one hand, nor on the other to over-estimate the expected profit.

THE JAPAN TEA TRADE.

CONSUL ROBERTSON in his report upon the trade of the port of Kanagawa,(Japan) for the year 1876, states that the export of tea amounted to 115,994 *piculs* 7 *catties*, valued at 3,473,178 dollars a fall considerably below the export of 1875, which was 134,415 *piculs* 67 *catties*, value at 4,813,458 dollars, a decrease of 18,421 *piculs* in quantity and of 1,340,280 dollars in value. Prices at the commencement of the year were high considering the quality of teas on offer, An idea that some reimposition of duty on tea would be made in the United States kept the market active with speculative purchases until the month of April, when the excitement entirely died away. With the opening of May first arrivals of new crop came in, and immediately found buyers at prices ranging from 42 dollars [illegible] dollars per *picul*. As supplies increased, rates declined, and about the middle of August good medium teas were in full supply at 19 dollars to 21 dollars per *picul*. This was the cheapest period of the year. The export continued steady, and during the month of November showed fairly large figures, owing to the departure of three sailing crafts for New York direct. With the close of the year the tea market might be considered as finished for the season, as settlements during the period until the arrival of the new crop teas were small and unimportant. Japanese producers have apparently become alive to the fact that they have fallen into the error of over-producing, and also that their teas are losing their former great popularity with consumers in the United States. They are now endeavouring to correct this by paying more attention to the picking and curing of the loaf, and the present season's produce shows a marked improvement as compared with the last two seasons. As the consumption of Japan tea is restricted to the United States, which market seems to have received last year more than it could dispose of causing a consequent depression of prices, it is not likely that the year 1876 has witnessed any increase in the area of the plantation. Indeed many native merchants assert that in some districts the tea plantations will in future be used for other and more profitable crops. Some samples of Japan black tea prepared under Chinese supervision have been shown, but no encouragement can be held out to the Japanese for producing them in quantity. The teas are handsome in leaf, but entirely devoid of any character or quality in cup, resembling low grade Amoy congou, and worth on the London market about 10½*d.* to 1*s.*, or in New York 22*c.* to 24*c.* per lb. Some shipments of Japan teas by native merchants under Government auspices have been made to New York, but prices realised there are reported to be so unsatisfactory that it does not seem likely that the experiment will be repeated. It is asserted that the losses, taking into account the market price at which the teas could have been disposed of in Japan to foreign buyers, exceed 120,000 dollars. The Californian trade is gradually changing, the somewhat gaudy lacquered tea chests and fancy packing, which were marked features of this business, are not now so popular, and several of the leading importers in San Francisco find it cheaper to import teas in bulk and pack them over there, having the papers necessary for each packing made up here. The facilities afforded by the railroads make Chicago an important distributing centre, and shipments to that city direct from Japan amount to 2,500,000lbs., or about 10 per cent of the total amount exported. It seems probable, Consul Robertson says, speaking of the current season, that Japan producers, warned by the low price at which teas were only saleable at the close of 1876, will greatly limit the amount of third crop leaf picked, and, as the United States' markets seem to point to an import of 18,000,000lbs. as a fully ample supply for each year, anything in excess being against the interest of shippers, there is likely to be a decrease in export. The past season 1876-77 showed an export of 22,50,000lbs., against 25,500,000lbs. exported in the season 1875-76, and this season the export from Japan will probably not greatly exceed 20,000,000lbs.

Acting-Consul Annesley reports in respect to the trade at Hiogo and Osaka that tea continues to form by far the largest article of produce from that district, and contributes the sum of 1,496,000 dollars to the total value of exports. Direct shipments registered at Hiogo were 6,470,624lbs., in addition to which 7,700 *piculs* were forwarded to Yokohama to be packed and shipped thence, giving a total weight of 7,497,224lbs., against a total weight of 7,648,960lbs. in 1875. This, however, does not represent the total produce for foreign consumption, as the native dealers have in addition shipped a considerable quantity for sale in Yokohama, the returns of which cannot at present be procured. A much lower range of prices ruled throughout the year than was current in 1875. The constant tendency towards lower prices is attributable entirely to the fact that the Formosa *oolongs*, which are somewhat similar to Japan leaf, are now entering into competition more largely with the latter in the American market. The consumption of tea, in the United States, although increasing, does not keep pace with the production, and unless some fresh outlet is speedily discovered, prices must continue to decline.

Consul Flowers writes from Nagasaki that the export of tea shows an increase in quantity of about 1, 300 *piculs* of all kinds, but a falling off in value of 138,116 dollars, which is to be accounted for by the serious decline in the value of tea has everywhere experienced. The production of tea in the districts near Nagaski has increased to a somewhat larger extent than is shown by those figures. A considerable portion of the Kiushiu growth finds its way direct to Hiogo and Yokohama, where it frequently commands higher rates than in Nagaski, owing to its suitability for mixing purposes. The very low prices which have been current seem likely, however, to check any further development of this industry for the present. Of the tea produced in the Province of Niigata, Vice-Consul Irons reports that it is estimated that a little less that 2 000 *piculs* finds its way to Yedo and Yokohama, partly through the medium of foreign merchants, and partly through the hands of Japanese dealers. Choice teas are not produced in this part of Japan. The teas of Echigo rank from common to fine and finest. Tea being a light article, is frequently sent from this part of Japan overland to Yedo. The tea of Murakami finds its way to Niigata by junk from Senami, and is then sent to Yokohama or Yedo either be steamer or overland. About 3,000 hands are employed in the cultivation and preparation of the tea in and about the town of Murakami. The leaves are picked generally five times a year. The process of preparing the leaf seems very similar to that followed in the more important tea districts of the south. A number of years ago some experienced tea workers were brought from the Uji district, in Yamashiro, for the purpose of assisting in the preparation of the leaf, and the result has been a marked improvement since that time. These remarks apply, with slight variation, to the districts of Muramaten and Niitsu, at both of which places the tea cultivation has been extended, and the preparation of the leaf improved of late years. The tea-growers of Kuroka also seem desirous of bringing their tea into notice. Many of the plants there are from fifty years old, and numerous younger ones are to be seen. There is, however, said to be something objectionable in the flavour of the Kurokawa tea, which is attributed by some to the contiguity of the petroleum wells to the tea plantations. At Shibate considerable attention has been paid to the planting of tea since about five or six years. Tea is also grown in Etchin and Kaga in quantity sufficient for export to other places. The amount produced has been stated of between 4,000 and 5,000 *piculs*.

CHINESE AND INDIAN TEA.

THE question has been raised on several occasions within the last few years, whether Indian tea will not soon supplant Chinese produce in the markets of this country. A report just issued by Consul Medhurst on the tea trade of 1875, brings the topic once more before the world, and throws, besides, considerable light on the less known features of the subject. Until the year 1860 China had a complete monopoly of the tea trade, not only in this country, but also in Russia, the United States, and India itself—the four tea-drinking nations of that time. In that year several English gentlemen combined to put in practice the experiment of planting in India, which had been mooted some years previously; and Assam, the province of India most nearly approaching in general conditions to China, was selected as the field for the undertaking. In 1861 not less than 1,300,000lbs. of Indian tea were exported to this country, but although this production justified the experiment, it was not supposed by any one that it threatened the old supremacy of Chinese tea. It was assumed that Indian tea could never compete with the best growths of Chinese, and that its sole use would be the addition of another article to those, limited in number, which rank among the exports of Hindostan. Even when the success of the Assam tea districts encouraged others to attempt similar operations in the country round Darjeeling, still no one ventured to question the recognised supremacy of Pekoe and Congou. In those years, too, be it remembered, the heavy duties on tea made that beverage a far greater luxury than it is at present. In 1868, however, the quantity of Indian tea imported into this country had risen to almost 9,000,000lbs., and some of the more sanguine of Anglo-Indians were heard to prognosticate the time when their tea would dominate the market. Whatever justice there may have been at the time to sanction so bold a declaration, it cannot be doubted that the course of events since has in every way justified this forecast. The importation of Indian tea into England, which stood in 1868 at 9,000,000lbs., had risen in 1875 to not less than 25,000,000lbs.; and 1876 and 1877 show a further steady increase. And more important still, in 1876 for the first time in the annals of the trade did the tea imported from China remain stationary, the excess consumption, amounting to almost 5,000,000lbs., being credited to Indian teas alone. If the same ratio be maintained in future years, the time is evidently not very far distant when this country will be almost exclusively supplied with tea by its Indian dependency. Nor has the falling off in the demand for Chinese teas been confined to England alone. India, which used to purchase a considerable quantity, now takes none. The United States, which prior to 1860 bought its whole supply from China, now takes not less than half from Japan. Combating on terms of dubious equality with its Japanese rival in North America, and finding a competitor rapidly approaching it in Indian production in this country, those seem to have good reason on their side who exclaim that the knell of the Chinese tea trade has been sounded.

It is of course certain that there must be some reason for this change. Admitting the superiority of the finest growths of Chinese tea over those of every other country, and assuming, as Consul Medhurst does, and as other high authorities affirm still more positively, that the soil of China is not worn out and incapable of producing good tea, it is palpable that some unfavourable cause must be operating to account for the falling off in the demand for Chinese tea. Consul Medhurst, in his interesting report, does not enter deeply into this matter, and if he was unable to acquire the requisite knowledge on that point, it can easily be believed that it is quite impossible for any one in a position less favourable for inquiry to say anything authoritative about it. Still it is just possible that there may be more in this suggestion than is supposed, and, in an indirect manner, it will be seen, that Sir Walter Medhurst arrives at a similar conclusion. But the chief reason, after all, is one that it lies with the Chinese themselves to remove. Indian tea has, of course, only supplanted theirs because it is a superior article, and its superiority lies not so much in its innate quality as in the more skilful manner in which the plant is converted into the article of household consumption known as tea. On the bush the Chinese tea is supposed to maintain its old excellence, but in the various processes that take place until it is placed in the hold of the "clipper" waiting to convey it to England or San Francisco, it is stated that it loses most of its native excellence, and becomes an article in every way inferior to the skilfully produced tea of Assam or Darjeeling. Sir Walter Medhurst says that not only is the poorness of quality accounted for by haste in preparation, but that the unsystematic way of converting the raw leaf into tea has much to do with its unmistakeable deterioration. At the present time the competition among the Chinese producers is so great, and the rivalry between English and American firms, both of tea merchants and ship-owners, so keen, that the great merit among them has come to be considered a mere question of priority as to time, and not as to quality. He is the most successful merchant or buyer who can land his tea in London docks a week before any other. His quality will not be questioned if it is the first of a "new season." The shipping agents derive enormous profits from this competition, and the receipts from one journey of some of these "clippers" would seem to many men a handsome sum to retire upon. The system that sanctions competition carried to so extreme a degree must be admitted to be susceptible of improvement. It rests chiefly with our merchants at Shanghai and Foochow to inaugurate a more judicious mode of procedure. This desire to be first in the field is reflected among the Chinese. The Chinaman is glad to get rid of his supply as soon as possible, if he is not out of pocket by the transfer. It matters little to him whether a few more days on the bush would have perfected the excellences of his tea or not, so long as he receives the same sum from the agent of the English merchant. The small proprietor, whose stock varies from 50lbs. to 500lbs. weight of leaf and who carries it to the nearest market, has only one object in view *viz.*, the conversion of his crop into money as speedily as possible. He fixes in his own mind its value, and is not to be discouraged by one or two failures in securing the price he has anticipated. This very delay, which generally occurs, as the Chinese producer seldom gets his price from the first agent he goes to, also operates unfavorably upon the tea; and the raw leaf rapidly spoils in the long delay that intervenes between plucking and firing.

It is very generally known now that firing is the most important part of the production of the article tea; and to carry out the whole task properly, it should succeed with scarcely any delay the act of plucking. In almost all cases, at present, the firing does not take place till many days, more often weeks, and some times months even, after the leaf has been gathered in from the bushes, and in that time it has probably lost most of its aroma and potency. The causes of the deterioration of Chinese tea are, therefore, two-fold. In the first place, the Chinese themselves not only unscientific in their manipulation of the plant, but they are improvident in their treatment of its produce. In the second the European merchant, by his jealousy of rivals, rather encourages these faults than attempts any remedial measure. The result is that the consumer who in the long run detects all these flaws, is applying to other quarters for that supply which he used to require from China. There is one bright spot, however, in the horizon for Chinese teas, and one which tends to show that they are still as capable of the highest excellence as ever before. Russia is still supplied exclusively from China, and in Russia, tea can be procured which even the choicest of Assam or Darjeeling growths are unable to approach. This fact is undoubtedly very important, for it proves that not only was the old supremacy of the finest orange pekoe justified, but that it might be regained. But the cause of this maintenance of the old standard of excellence is solely the presence of Russian overseers and Russian capital in many of the districts whence tea is exported to Russia through Ourga, and not in any way the skill or providence of the Chinese themselves. The absence of the fierce competition existent between English and other merchants is also another reason for this superiority. But although China may be able to secure for itself the monopoly of the trade with Russia, it is certain that unless some very great improvement takes place it will be completely supplanted in England by Indian teas, and in the United States by Japanese. Sir Walter Medhurst is of opinion that nothing but the introduction of European capital and enterprise into the country can save the tea trade from decay; and it is patent to all that the skilful manner in which the raw article has been manipulated in Assam and Sikkim has more than sufficed to create no unworthy competitor to the admittedly superior leaf grown in Chinese provinces. The Chinese should know by this that no inherent merit in their tea plant will obviate the necessity for a careful treatment in the process of its conversion into the article of consumption, and they cannot but recognise very formidable rivals in Assam and Japan. As Sir Walter Medhurst says, the truest remedy lies in permitting foreigners to have free access to this country; then we should see the same scientific principles applied in China which have been tested with such satisfactory results in India, and there would be little doubt that Chinese tea, instead of showing a falling off in consumption, would share in the natural annual increase of the public demand. It is too probable, unfortunately, that many years must elapse before the ruling Mandarins will sanction so enlightened a course, and by that time Indian teas may easily have supplanted their Chinese predecessors in the estimate of he householders of this country.—*Standard.*

COFFEE.

WE hear from Java that on account of the failure of the usual rains, great distress is anticipated. It is said that fodder for cattle is scarcely procurable, and that coffee plantations are heavily suffering.

A CHEMICAL work is about to be started in Colombo, for the manufacture of coffee manures. The Company which have gone in for the venture, are prepared to strain every effort to secure its complete success.

We are glad to learn from Ootacamund that some of the coffee crops this year have been exceptionally good. One estate in the valley, of 360 acres, has given a crop of 400 tons, and a small estate of 25 acres in Kotaghery, a crop of 12 tons.

AT the last meeting of the Coorg Planters Association, the evil of coffee stealing in that and adjoining coffee districts received exclusive attention. The Superintendent of Coorg has been requested to solicit the Chief Commissioner by telegraph, to urge the Supreme Government to pass such immediate measures as may tend to suppress this crying evil. In the meanwhile, the planters have decided to engage *peons*, to patrol the roads in and near Bazars, and in the neighbourhood of coffee estates, to deter as far as possible *maistries* and coolies from stealing, and petty shopkeepers from buying stolen property.

COFFEE-planting in Coorg is fated to prove a ruinous speculation, in spite of the hopes to which some planters in that district desperately cling, if we can believe all that is said regarding it. The necessary combination of soil and climate required for coffee plantations it seems, is found in very few localities in Coorg, and where it is found, the ravages of the borer, and other enemies of the coffee tree, negative the advantage. An idea was entertained by some planters, that the borer would leave the coffee-tree when the young bamboos grew up, but the young bamboos have grown up, and thrown out seed, and the borer is still with the coffee.

LIBERIAN COFFEE.

LIBERIAN coffee is said to have been a great success in the Rangoon Agri-Horticultural Gardens, and the active Secretary has recently supplied the American missionaries at Tonghoo with some plants; so it is to be hoped the plant may prove as successful as the cinchona planted on the Tonghoo hills some years ago. When the Tonghoo railway is opened, there will be a rapid outlet for all the produce that can be grown there.

LIBERIAN COFFEE.—Says the *Bangalore Spectator* :—It is surprising and disheartening to note the evident unwillingness of the local Government to encourage and foster any new enterprise. For instance the experiments made with Liberian coffee in the Lal Bagh, have, as yet, proved eminently satisfactory. If as we pointed out recently, Liberian coffee is found to grow and flourish at an elevation as low as that of Bangalore, then a new enterprise can be started in our neighbourhood, and tend to increase the prosperity of the place, To this end the Government should have procured a large number of plants, and distributed them to residents desirous of experimenting with them. There is little use of distributing plants to Commissioners and Deputy Commissioner in the Province, while those most interested, *viz.*, private capitalists, are ignored.

To the *Ceylon Observer* we are obliged for the first report upon Liberian coffee *in the pot*, and our esteemed contemporary speaks thus of its qualities as a beverage.—

"We suppose we committed the mistake most people do with Assam tea,—put too much in the pot,—for there can be no question that the result was a strong,—*very* strong cup of coffee. Our anticipations that Liberian coffee bears the same relation to Arabian that indigenous Assam tea does to China are entirely fulfilled. As people gradually get to prefer Indian tea to all other kinds, we can understand our American cousins' preference for the Liberian bean. In any case the grocers who sell coffee ready ground will be sure to value this stronger kind, to mix with the weaker. On the other hand, we learn that the visitors who tried Mr. Agar's coffee carefully roasted and prepared at Mount Lavinia House, could scarcely distinguish it from the ordinary kind. We suspect the rough, rank taste of which a London correspondent complained, was the consequence of the berries being picked in Liberia in an unripe state and not properly cured."

SIR JOSEPH HOOKER ON LIBERIAN COFFEE AND ITS ENEMIES.

THE demands for this plant (first grown in this country at Kew in 1872), which has excited the expectations of coffee planters in all parts of the world to the highest degree, far exceed our means of supply. Now, however, that the function of this establishment in introducing the plant into the coffee-growing districts of India and our Colonies is amply fulfilled, and both the seed and plants are to be had from Mr. Bull, of Chelsea, and Messrs. James Irvine & Co., of Liverpool, as well as other firms, no further supply will be kept in Kew than suffices for exchange of specimens with other Botanic Gardens and correspondents. Mr. Hiern has examined the African species of the genus "Coffea" in preparing the "Rubiaceæ" for the forthcoming third volume of the Flora of Tropical Africa. He has determined the claims of the Liberian coffee to be regarded as a distinct species, as was indeed the opinion of its scientific discoverer, Afzelius, and he has described it in the transactions of the Linnean Society [second series Botany, I., p. 171, tab. xxiv] under the name of "Coffea Liberica." I am indebted to Mr. Hiern for the opportunity of distributing with his report copies of the plate of the plant which he has published in his memoir.

I may enumerate as the most important recipients during the past year :—Bombay, *Burmah, *Cape of Good Hope, Dominica, Java, Madras, Montserrat, New Grenada, Queensland, Rio de Janeiro, *Trinidad. The places marked with an asterisk, had not received it the previous year.

From the numerous favourable notices of the plant which I have received, I will content myself with quoting some from all sides of the world.

Dr. Thwaites (of Ceylon) writes, under date of 29th August, "The seeds of the first plants of Liberian coffee you sent to me have become larger bushes and are producing berries, These latter are of a large size, but they ripen very slowly, evidently from the want of a higher temperature, so I am distributiong some plants in the low country and near the sea." In his report for 1875 he also expresses the opinion that though the plants have become affected with the leaf disease, they "do not apparently suffer here [Peradeniya] from the *hemileia* so severely as our ordinary coffee."

In the Malabar district of South India the Liberian coffee has also disappointed the expectation which its large and leathery foliage seemed to encourage of its capacity for resisting the *hemileia*. Its more vigorous habit of growth may, however, enable it to bear without succumbing to the ravages of this insidious parasitic mould.

Dr. Imray (Dominica) writes while this report is in preparation :—"I am thoroughly convinced that the Liberian coffee will in time take the place of our native coffee, if I may so call it, I think you would be pleased were you to see my Liberian trees with their healthy vigorous branches and large dark green, bright shining leaves. Many of the trees are still flowering, and a small crop of berries is coming on. The plant must evidently be very prolific I count as many as 15 or 20 berries, even more, in the axils of the two opposite leaves. It appears to me that the new species of coffee is peculiarly adapted to this island, so far as the temperature and rainfall are concerned : the climate approximates very closely to that of Liberia from whence the plant comes. If the cultivation of Liberian coffee is generally taken up in Dominica, as I think it will be, there is a future for this little country. There are thousand of acres of splendid coffee land that might be cultivated in this island with no fear of the 'white fly' before the eyes of the planter, for the Liberian tree bids defiance to its attacks. Indeed there is a very eligible field for settlers here with a little money in their pockets who wish to cultivate coffee. It might be pleasanter and more profitable in the long run to set their faces towards the west, instead of the "far east."

The suppression of this product generally in Dominica, which island once yielded the finest West India beans, has been the subject of correspondence with the Colonial Office. This led to the mission, of Mr. Presto, the Government botanist of Trinidad, to Dominica with a view of reporting on the subject. Mr. Prestoe's report, which is in every way an admirable one, deals with all the vegetable products of the island in an exhaustive and most instructive manner, and in respect of coffee it shows that the cessation of its cultivation was not due to the larva of a small moth (*Cemiostoma coffeellum*), which can be extirpated from a plantation with great ease, but to causes which are far more general, affecting the well-being of the whole island, and especially to mismanagement on the part both of the Government and colonists.

A strong desire being evinced in Ceylon to ascertain the condition under which Liberian coffee is cultivated, in the expectation

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NOTICE.

Mr F. A. Cohen is appointed Manager of the STATESMAN AND FRIEND OF INDIA *Office, and has assumed charge this day.*

All communications concerning the general business of the Office, Advertisements, and Subscriptions to the daily STATESMAN AND FRIEND OF INDIA, weekly FRIEND OF INDIA AND STATESMAN, *and* INDIAN AGRICULTURIST, *should be addressed to Mr Cohen.*

All Remittances on account of the Office should be made, as heretofore, to Messrs Nicholls & Co., Financial Agents.

R. KNIGHT,
Managing Proprietor.

Calcutta, 18th April 1878.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb 1876.

R. KNIGHT.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

COAGULATING MILK.

TO THE EDITOR.

SIR,—In a copy of Bingley's "Useful Knowledge," I see that the flowers of the Artichoke are used in France to coagulate milk for cheese. Will you kindly enquire in your paper, if one flower or less should be used for one seer of milk.

A. B.

WAGES IN NORTHERN INDIA.

SIR,—Can any of your correspondents inform me, what have been the general movements of wages and the supply and demand for labour during the past say 20 years in the various parts of Northern India, *viz.*, Bengal, Punjab, North-West and Central Provinces.

So much has been said about high and low prices, that an inquiry with the corresponding movements of wages is necessary in the interest of

POLITICAL ECONOMY.

NOTE.—The question is one of vital importance, but it can be answered only by the institution of extensive inquiries in the matter. We commend it to the Famine Commission.—ED. I. A.

BHOLA WOOD.

SIR,—In the Report on Government timber operations in Assam, I see *Bhola Wood* stated as *Morus laevigata*. I always thought it was *Terminalia Citrina*. When in that part of India, I noticed that the oars of canoes were always made of *Bhola*, a very tough, elastic wood suited to the rough work entailed on them in the rapids. For this reason I was led to adopt it for my fishing rods, some of which, more than twenty years old, are still in use and sound. The wood is at first bright yellow, but soon changes to brown, its sap being full of tannic acid.

W. H. S.

A PLAN TO UTILIZE A DESERT.

SIR,—Throughout Northern Africa and the drier portions of Western and Central Asia, *date* is the staff of life to millions. The date tree flourishes where agriculture is impossible, and is the source of large profit as well as common sustenance wherever it is cultivated.

It is now proposed by our Commissioner of Agriculture at Washington to make dates a staple American product also. The centre of this new enterprise is to be the now worthless desert regions of Southern California and Arizona. Seed has been procured from Egypt and successfully planted. From what I have seen of the date producing regions in this part of the world, and from what I know of the desert of the Colorado, between Carrizo Creek and Fort Yuma, I am inclined to believe that the greater portion of the latter region can be made productive and very valuable by making plantations of the date palm. This tree not only does not require much water, but much water is prejudicial to it, and the climate of the Colorado desert is singularly similar to that of some of the best date producing districts [illegible]. In any case I feel assured that all the river portion of the Colorado desert would grow the date tree without difficulty.

AMERICAN.

THE NEW PLANTAIN.

SIR,—In reply to the enquiry of your correspondent "Rama Varma, First Prince of Travancore," regarding the best way of obtaining this choice species of plantain, it would be first necessary to address the Chief Commissioner of Assam, who might possibly think fit to assist the applicant. The local name I have quite forgotten, as nearly 20 years have elapsed since I was a dweller in Assam. During the cold season the intermediate tribes communicate with the little known Shan people. An intelligent native gardener should be sent up *via* Calcutta, at any time from November to March, to pack and take down by the steamer, and N-E Railway, any specimens obtained.

Either the "Singphoo Chiefs" on the Bowree Dehing, or the Kampti settlement near Suddya,—'Chow Kens' tribe I mean—that chief is dead, but I know he has left sons or nephews on the lands, who perform Frontier Protection Duties for the British Government. *Barter*, and not money dealings are the rule up there. Large well-finished clasp knives, fish hooks, &c., &c. would be good articles to take. The plants would come down to Debroogurh, Assam, by canal.

A very rainy climate, shady forest situation, and a soil of decomposed vegetation, would be necessary to grow this plantain, besides a winter without frost. There are many other desirable fruit trees of Shan origin, now common in the valley of Assam.

The beautiful *Pruno cerasus jencinsii* (*Teraizoo* of Assam) a Damson like fruit, on a very elegant tree. *Pierandia Sapida* (*Lutkoo*) a *litchi*-like fruit, of very delicious nature. *Xanthocymus dulcis* (Assamese name I forget), a lonely tree with delicious golden fruit—occasionally seen about Debroogurh. *Flacourtia* (*Panyala*) a nice juicy kind of plum. The dye plant of the Shans (*Prulia Indigotica*) *Room*, a small shrub supplying the dark blue dye of those wild people, and used by other tribes for a similar purpose.

All these require the same soil, and climate, as above stated. I should think "Courtallum" the proper place.

W. H. S.

EURASIAN FARMS.

SIR,—I would suggest to the Eurasian Association, the formation of an Agricultural Company, with, say, a capital of 3 lakhs of rupees, divided into shares of Rs. 100 each, for the purpose of working farms on the European system, with the aid of sub-managers and paid labourers. Government would no doubt give them a grant of 10,000 acres at Re. 1 per acre for some years; this could be divided into 80 farms of 100 acres each, leaving 2,000 for grazing and cattle-breeding purposes.

The monthly and annual cost of each farm would be—

1 Sub-Manager	50	
4 coolies at 5 per month=20=70, or=840 annually.		
4 pair bullocks at 40 per pair	160	,,
4 English ploughs at 40	160	,,
4 harrows at 40	160	,,
Tools, &c., seed	100	,,
Buildings	2,000	,,
Rs.	3,420	

And the produce might be calculated at—

2,000 maunds of wheat at 20=	200
2,000 maunds of rice at 20=	200
	400

or about 12 per cent. on the outlay.

The annual cost of all the farms might be estimated at Rs. 2,73,600, and produce about Rs. 32,000.

But the expenditure after the first year would be less, allowing a greater profit, which would be added to by rearing cattle, and it would afford employment to 80 persons, and if successful, would lead to the formation of other Companies and open out the resources of the country.

But they should confine themselves to the growing of wheat and Carolina rice, which is planted in ridges 3 feet apart and needs no transplanting and little irrigation. As the profits of the Company increase, they could provide for artificial irrigation.

The investment would be safe, as the farms would be worked by paid servants and provide a home and employment for the rising Eurasian population; the balance of the capital would be for contingencies, such as wells for drinking purposes, &c.

PHILO.

Calcutta, 2nd May 1878.

BAMBOO AS PAPER STOCK.

I regret, to see the doubts you express in your foot note to "Anglo Burman's" letter published in the March number of your journal as to financial success, of converting Bamboo into Paper Stock. but these doubts possibly are influenced by reasons peculiar or incidental to the country which I may not know; however as to the profit, attaching to the production of the "stock" from bamboo itself, my details of cost, derived from actual practical operations here *de die in diem*, leave no room for doubt; this of course assuming that the young bamboo shoots can be procured and laid down * at a factory somewhat approximating to the cost I have set down, either from the Native forest or *plantation*, giving strongly the preference to the *latter*. The stock produced from the bamboo by my system, is so good in quality, so superior to *esparto*, and would afford such increased facilities to our paper-makers, that it would be rapidly taken up by the trade, owing to the superior character of the paper it would produce. I estimate, allowing, I believe, amply for all contingent expenses in excess of the mere manufacture, that it can be laid down in London or Liverpool, at from £16 to £18 per ton, and will certainly realise from £22 to £24, and this is *below* its actual value.

The difficulty is, in the present disturbed state of politics and commercial depression and want of confidence, to induce capitalists to embark *in any* undertaking, however promising: my only course, therefore, is to ventilate the subject as much as possible, and therefore I find your assistance most valuable.

Distrust generally attaches to all new undertakings, and all removed from the "beaten track," and I am rather unfortunate in trenching on the preconceived notions of the botanists. I trust however Mr. Thomson's practical letters will tend gradually to modify these, and so far as the practical issue of the manufacturing portion of the question is concerned, I feel assured I shall have our paper trade with me; I mean that it would be very difficult to assign a limit to the quantity of the stock that would be readily absorbed.

Herewith I send a letter, which I trust you will insert, replying to 'Anglo Burman's' groundless fears, as an evidence of which, Dr. Brandis lately sent me a report from Dr. Schlich recording a visit he made to Arracan, where he reports that the bamboos formed a pathless forest of upwards of 1,800 square miles, through which he had to cut his way, although the district was traversed by streams affording ready means of transport.

Within a few short years, what was rice in Burmah—what jute in Bengal? What are they now? I firmly believe that bamboo is destined to assume an equally prominent position on the exports from our Indian Empire. Coffee, Cinchona, Tea, and now the Indian-rubber plant, have attracted the attention of capitalists; Bamboo I am certain will do likewise, and yield a safer and more lucrative return.

CLAXHEUGH, SUNDERLAND; THOS. ROUTLEDGE.
23rd April, 1878.

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* This is precisely the point on which the whole question centres. Can young Bamboo shoots be produced on *plantations* and laid down at a central factory at this price, and leave a margin to the cultivator?—ED., *I. A.*

MR. ROUTLEDGE'S REPLY TO ANGLO-BURMAN.

SIR,—I am glad to see from the March number of your journal, which I have just received, that the ventilation you have afforded my scheme for utilising bamboo as a paper-making material, is attracting some attention, and welcome the letter of your first correspondent "Anglo-Burman," although he seems to fancy I propose "poaching on his preserves." He is, I think, somewhat unduly alarmed, and might indeed as reasonably complain that the demand for Burmese rice during the past few years has ruined the "*poor*" cultivator, or that the enormously increased trade in jute has paralysed the "Bengal ryot," whereas it is notorious that the reverse in both cases is the fact.

If "Anglo-Burman" will look into the question further, I think he will find that both the bamboos used for building by the "*poor*" cultivator, as well as the large quantities floated down to Rangoon and Moulmein, are abstracted, as it were, from the mere fringe of the native forest, the stools from which they are cut not being injured in the least thereby, but reproducing fresh shoots for the next year's collection; in other words, the annual cutting of the stems in moderation does not affect the reproductive power of the parent stool. The bamboo indeed is singular in this respect, and probably no plant is productive to the like extent, either for rapidity of growth (and that annually without any cultivation), or for the large quantity of available stems thrown up on a small area of ground (forming in many cases almost impervious jungle) in localities suited for its growth.

There is however another view of the question to which I invite "Anglo-Burman's" attention, as by it his friend, the "*poor*" cultivator, will not be injured but probably materially benefited. I do not propose to employ the bamboo stems now utilised for building and other cognate purposes, in fact being old, woody, and coated with silica, they are not suitable for paper-making material. I propose to convert into "stock" only the *young herbaceous shoots* of the season's growth, and I also propose, in order to ensure the proper choice and collection of these, to organise regular plantations, as practised for other agricultural products, notably sugar, rice, jute, flax, cotton, &c. &c., with this very great advantage over the staples just named, that a plantation of bamboo once established on the system referred to by Mr. Robert Thomson (whose letter to Sir Joseph Hooker you publish in your March number) under *Irrigation*, it is simply a question of "*cut and come again*" indefinitely, no cultivation being required, but simply rotative cropping, a plantation thus formed of say 5 to 600 acres would amply suffice to supply a factory producing 100 tons "of Paper Stock" weekly, all the year round.

Indeed, in any case I would urge the installation of a plantation under this system, if only to economise to the utmost the carriage cost of so bulky a commodity as young bamboo shoots, it being understood that such plantations should be located within easy communication to the factory, where the stock would be produced, and the factory itself in proximity to the port of shipment.

Assuming these desiderata or essential points assured, I know of no other raw material that can furnish a staple article of commerce at so low a cost, at once commanding a market greedy to absorb any quantity that can be supplied, and yielding such profitable results as Bamboo.

CLAXHEUGH, SUNDERLAND; THOS. ROUTLEDGE.

23rd April, 1878.

LAND SETTLEMENT.

SIR,—I see a discussion in the columns of the *Statesman* on the land tenures of India, on which, as an old settlement officer, I beg to offer a few remarks. It may not be generally known that our present settlement operations are based on the culturable area of a village, on which an acreage is placed, its division among the holdings being left to the headmen of villages. Thus the rental falls heavily on some holdings and lightly on others. What I would suggest would be a thorough investigation of each holding, field by field, and the fixing of the rental in accordance with the productive quality of each field. The rental could be fixed at ½ or ⅓ as it might be expedient, but I think no cultivator would grumble at ½ if he could get a lease on that basis for ten years or more. This enquiry could be carried out by an intelligent Ameen with only two chainmen, without any Sujras and Kasras and other paraphernalia of a settlement survey, if only aided by two headmen of a village. His examination should be recorded for each holding, field by field, as follows—the sum of the holdings forming the rental of the village, and affording a record of each holding for reference at any time :—

Name of Village.	No. of field.	Measurement.				Area	Estimated productive value.	Government rental fixed	Remarks.
		N	S	E	W	A R P			
Rampore.	1	10·2	5·20	04·8	6·40	4 2 6	10 9 0	2 10 4	The fields are double or produce two crops
	2	5·80	6·40	2·80	2·90	2 3 20	5 9 6	1 6 4	
	3	4·80	6·40	2·90	3·20	3 3 20	4 8 6	1 2 1	
	6					12 0 6	20 11 6	5 2 1	

A similar record would be made of each holding and compared with the rental paid in previous years, and if found excessive, could be re-investigated by the supervising officer.

Another great bane of the cultivator is the money-lender. An enactment is sadly needed exempting agricultural implements from seizure by a decree of court, and preventing the recovery of more than 12 per cent. simple interest by law. These two remedies would very soon improve the status of the cultivator, and gradually put an end to sales for arrears of revenue, as the owners of holdings would consider themselves of some importance, and their prosperity would be insured. I shall leave my suggestion to the consideration of those who have spent their life in the study of land tenures. Any suggestion that would improve the resources of India and its prosperity is worth a thought.

PHILO.

Calcutta, 10th May 1878.

REGRESSIVE METAMORPHOSIS IN THE COCOANUT TREE.

SIR,—In general physiology, the term Metamorphosis, as it is commonly known, is adopted to mark the successive modifications of form and structure, which organised living bodies undergo, not only collectively, but also in their organs, and in the elements of these organs, or in other words, all the phenomena of life in organised beings, from the appearance of germen until the complete development of the individual, lay before us an uninterrupted series of transformations, which perform as many metamorphoses, more or less visible. It may, therefore, be inferred that a state of metamorphosis is the normal state of every living being, and that the unceasing transformations going on in the same beings, are but the essential conditions of life.

Now when applying these considerations to the vegetable kingdom, we observe that the leaves on the stems and branches of plants, when they approach to their natural end and to the flowering season, become much smaller, changing in form and colour, transforming by insensible graduations, from common leaves as they were, into tracts, spathes, septals, petals, stamens and pistils, thus giving birth to flowers and fruits.

Hence comes the judicious distinction made by Professor Daniel Oliver between foliage-leaves and flower-leaves. The gradual transformation, therefore, of type-leaf into flower-leaf is a normal and *progressive* metamorphosis, which leads to the complete development of the individual and to the reproduction of the species, whilst the regression of floral-leaf to type-leaf is a metamorphosis which might be called *regressive*, as it paralyzes the complete development of the individual and prevents the reproduction of the species.

Such instances of regressive metamorphosis, however, are far from being usual, and to better understand the subject, it may be useful to mention here, what Daniel Oliver, in his "First book of Indian Botany," page 92, observes, saying. "The stamens, in many plants, have a strong tendency to loose their character as *staminal-leaves* and to assume that of petals, as you may find if you compare a double with a single rose." Such modifications of stamens into petals, although abnormal and not properly progressive, are by no means strictly regressive ones, because the double rose still contains other normal stamens, whereby the reproduction of the species is performed, whilst in the following instance the character of a complete regression metamorphosis is most striking.

At the margin of the right side of the river Tuary, almost fronting the anchorage of Mormugam, lies the village of Siridam, near which is an old estate belonging to the heirs of Colonel José Paulo de Oliveira Pegado. At a distance of about 200 *metres* from the shore, there can be seen a cocoanut tree, producing in the axil of each leaf a bud, which instead of being composed of a single spathe containing only one spadix very ramified, nourishing masculine and feminine flower, consists of a series of 30 to 40 spathes enveloped one by the other; and from the axils of nearly all these spathes spring out as many buds, each composed of a second series of less number of spathes.

The majority of these spathes, and chiefly those of the second series, in their state of full development, become transformed into as many pinnate leaves (*olas*), similar to those of the cocoanut tree in every thing, *i.e.* in the long thick, fibrous, and amplexicaul petiole, as also in the woody and hard midrib (*vir*) of distic, equidistant and linear-lanciolate leaflets, with the single difference that all these leaves are smaller than those of grown up cocoanut trees, but yet as large as those of young cocoanut trees, two or three years old; so that it is delightful and amazing to behold that cocoanut tree, with its full plumage of large leaves, 16 *metres* high, adorned by a large number of such small cocoanut trees springing out in the axil of each leaf. On the 10th of February ultimo I went to see, for the last time, this extraordinary cocoanut tree, which may be about 40 years old and which far from getting stagnant, vegetates vigorously enough. I was informed that it never produced cocoanuts, but merely buds, such as above described. I collected some samples of these secondary cocoanut trees, planted two of them in my farm at Tuary, although with no hopes of success and brought the remainder to the place of my residence at New Goa, where I shall keep them carefully and shall be glad to exhibit them to any one, who may desire to examine them. Yesterday I made a trip to Britona, a village half a league far from Pangim, at the right margin of the river *Mandovy*, in order to inspect a cocoanut tree, 21 years old, which is to be seen there and which is like the one above described. The teratologic phenomena in this cocoanut tree follow the same law as in the case of the first one, with the difference that in the latter instance, the metamorphosis is more complete, as all the spathes of the first series except the first one (perhaps on account of its being more coriaceous) are transformed into ordinary leaves more than two *metres* long and one broad, and the spathes of the second series, *i.e.* the minor buds, which spring out in the axils of the first one, become changed into as many young cocoanut trees of a third rank, which have in the small stem of secondary young cocoanut trees, the same relative position, as the latter have in the stem of the cocoanut tree, the roots of which are in the ground.

I do not suppose the teratologic state of those cocoanut trees is due to the silicio—lateritico nature of the soil, where they grow, and I leave to others, more competent than myself, to inquire into its real cause, as surely there must be one; for now-a-days, since the writings of the celebrated Haller, Et. Jaffroy-Saint, Hilair, Winslow and others, so called *monstrosities* are no more considered to be *errors of nature or divine signs*, but merely a deviation from natural laws in consequence of the extraordinary intervention of some accidental cause *affecting* the development of the organised being. It becomes also patent, from the described fact, that teratologic phenomena, as revealed the microscope, often bring to light certain unknown modifications of organism.

Some buds of the cocoanuts referred to, having been prepared for extraction of the sacharine liquor called *sura* or *toddy*, by the same process as employed in case of buds of ordinary cocoanut trees, did not produce a single drop of it, hence it follows that the secretion of such a liquor is only performed by flowers, both masculine (which are more numerous) and feminine.

J. DE MELLO DE SAMPAYO.

Goa, 10th April 1878.

THE RYOT IN BEHAR.

SIR,—That the poverty of the ryot is greatly to be attributed to the poverty and exhaustion of the soil he cultivates, is doubted by some writers on the subject. These persons may have very good intentions, but it is very evident that they do not know what they are writing about. How do they account for homestead fields producing all the superior kinds of crops, which refuse to come to maturity in outlying fields? As the villages are built on the highest sites in the country—the land in their immediate vicinity is naturally poor and sandy; but still with aid of manure this land produces three grains for every one grown in outlying land, although the latter has probably soil that *could* be made superior to the homestead land.

Have these writers ever cut and averaged the produce of his ryots' fields? I have, and the following results will conclusively prove how grateful the soil is when properly treated.

Sarun, average of Rubbee Crops, Season 1876-77.

No. of Field.	Farmed by	Description of soil.	Sown with	Mode of Treatment.	Produce in grain per beegah of [illegible] sq. feet.	Produce in chaff & straw per beegah.	Increase of grain in comparison with No. 1 field	Increase of straw & chaff.
					M S C			
1	Native	Deep loam	Barley and wheat	Unmanured *rubbee* sown after a crop of maize had been reaped	6 37 2	10 25 0		
2	Native	Ditto	Wheat	Kept bare fallow during the rains, and manured with cowdung	11 15 0	33 5 0	8 17 14	22 20 0
3	Factory	Ditto	Pedigree wheat	Dug up and sown after a heavy crop of indigo had been [illegible]ed. Unmanured since 18[illegible] when it received dressing of indigo seed, which was dug in	20 25 0	68 30 0	13 27 14	58 5 0

These results are rather startling, but I can vouch for them; and at the same time guarantee field No. 1 to be capable of producing as much as field No. 3, if only assisted with a little manure. What nonsense it is for your correspondent to say that, "the means do not exist in this province, for high cultivation." What, not with a rural population of nearly 800 souls to the square mile? The country would be cultivated like a garden if a [illegible] system of agriculture was introduced, and the ryot was made independent of his zemindar. It is wrong to say that "the men themselves have not the stamina for work"; as, away from the depressing influences of their wretched homes, ryots develop at once into energetic and painstaking workmen. The following analysis of Behar soils by Mr. Fleming of Barochan, made about fifty years ago, will show that the soil is becoming more impoverished year by year, under the present wasteful system of agriculture. Mr. Fleming mentions 30 and 50 bushels of wheat, as the average produce of land near Gya. Will two per cent. of the land produce that amount now? 20 bushels per acre is nearer the mark for season 1878, and we shall find it dwindle down to 15 before the end of the present century.

Analysis of Behar Soils (200 grains of each being analysed.)

Water of Absorption.	Matter destructible by Heat.	Carbonate of Lime.	Carbonate of Magnesia.	Oxide of Iron.	Alumina or Clay.	Silicious Sand.	Calorides, sulphates Nitrates.	Loss of Weight.	REMARKS.
22	4	15	7	12	9	120	2	9	*1st.*—Near Gya, of a dark colour, soapy to the touch when moist, hard, and cracks when dry; yields a crop of rice and one of wheat every year. Never lies fallow, but is covered with water during the rainy season, and is productive from 30 to 50 bushels of wheat per acre.
20	14	10	8	13	14	115	1	5	2nd.—Soil from the same district, also soapy when moist, and cracks when dry, rather more productive than No. 1.
20	6	11	4	27	20	110	3	6	3rd.—From the same district. Heavy red clay soil, producing wheat, pease, cotton, or poppy in the dry season, and Indian corn or millet in the wet season; not inundated in the rains, and sometimes manured with ashes of wood and cow dung.
19	9	9	1	2	16	130	7	7	4th.—Soil from North Behar, Tirhoot, a deep loam, yielding two crops yearly, not inundated, producing wheat, barley, Indian corn, indigo, poppy, &c., from 25 to 35 bushels of wheat per acre; is not usually manured.
18	7	8	2	1	12	140	6	6	5th.—Tirhoot, soil light coloured producing nearly the same crops, but not so productive as No 4. Saline efflorescence in patches.
12	3	4	0	1	5	152	14	9	6th.—Tirhoot, not so productive as No. 5, and some patches nearly sterile from the saline efflorescence, except in the rainy season, when it produces good crops of Indian corn. Soil light-coloured.

The question is too serious to be dealt with lightly, and people should study the subject before venturing upon the remark—"I do not believe in the impoverishment of the soil theory." If they did so, they would find that the impoverishment of the soil is a melancholy fact not to be gainsaid by any amount of tall-writing.

AGRICULTURIST.

AGRICULTURE IN GOA.

SIR,—You may be glad to know about the proceedings of his Excellency the late Governor of Goa, relative to the experimental agricultural farm, established by him in these territories. The following facts are at your service:—A site was selected in the city of Old Goa for the farm, where the great arsenal of Goa once stood. The farm is on the left bank of the Mandouy river, a central position for all the provinces, with easy communication by the different rivers. It is distant from the city of Nova Goa 15 kilo-metres (9·3 miles) and about 22 (13¾ miles) from Agoada. The Government does not possess any other land near the city. The land is suitable to various species of culture, and the farm measures about 18 acres. It is unfortunately unhealthy, but the causes are disappearing day by day, and the establishment of the farm will do a great deal to improve the sanitary condition of the place. It is not true that the Government has sequestrated the private funds of any Church for the expenses for the farm. Not a pie has been asked of them. The amount has been raised from the village communities; not a great sum,—4,000 rupees per annum, divided amongst more than 200 villages. The communities did not all reclaim against the measure, and some of them approved the little sacrifice asked of them. The village communities possess the largest and best part of the soil of Goa, and they are more interested than any others in introducing improvements in the old agricultural system followed till this day. A general tax might be more just, but even this would fall principally upon the village communities. Any new tax will of course excite the opposition of the newspapers against the Government, as the sanitary taxes imposed by his Excellency the Governor to improve Nova Goa were imposed. I am anxious to get a site near Pangim, but the Government does not possess land so near as this station, for the pupils of the agricultural school, which I teach, and which is established at Nova Goa.

The *Patria*, *Gazeta do Bardez* and *Ultramar*, were in constant opposition to the administration of the late Governor Vice-Admiral Sergio deSousa; but the *India Portugueza*, *Dowasudaranewo*, *Civil*, *Sacao* and *Nova Goa* approved of the measures of his Excellency. I think it right thus to defend the memory of his Excellency who died suddenly of malarious fever, at the palace of Caro, on the 3rd instant.

J. DEMELLO DESAMPAYS, *Capt. R.F.*

Nova Goa, 16th May 1878.

The Indian Agriculturist.

CALCUTTA, JUNE 1, 1878.

IMPROVEMENT OF NATIVE AGRICULTURE.

I.

THE monthly reports of what is going on, on the Government Experimental Farms, show plainly how much we are in want of a man capable to direct the superintendents and officers in charge, as to experiments to which it would be expedient to confine themselves. A great deal of the very small amount set aside for these farms, is spent uselessly in the cultivation of crops with the sole object of converting them into money to enable the officers in charge to show a fair balance at the end of the year; and the special knowledge of the superintendents, or such agricultural talent as we may find among them, is simply wasted in conducting, and superintending agricultural operations, which are within the range of the mere peasant. We cannot blame the officers in charge: they cannot be held responsible for this strange waste of their time and public money, the fault lies with the system, with the policy which Government has adopted with reference to these farms. According to this policy, the object which the superintendents of these model or experimental farms must endeavour to attain, is to make the farm pay its own expenses, and prevent its being a burden on the public purse, and *that* superintendent is considered the most efficient, who can show in his yearly balance sheet that the sale of the produce of the farm covers its expenses.

Need we point out the fatuity of such a policy? The very name which has been given to these farms, stands in direct contradiction to it. But small as the amount is which the Government reluctantly devotes to the up-keep of these farms, ludicrously small, when compared with the amount which Germany, France, Austria, America, or even one of the large land-owners of England devotes yearly to agricultural experiments, small as the amount is, it is to a great extent thrown away for the want of a directing mind, for the want of a properly defined policy. We want these farms to be the medium of introducing an improved system of agriculture into the country, than which no greater benefit could we confer on the vast agricultural population of this Empire; but under this penny-wise and pound-foolish policy, the attainment of this object is *impossible*, and we might just as well shut them up for all the use they are at present.

His Excellency the Governor in Council, in his directions to the Famine Commission, now sitting, says:—"It is apparent that the improvement of the practical agriculture of such a population as cultivates the soil of British India, is a task of great difficulty. Of late years, some attempts have been made to promote this object. Their success, however, has been questionable, and measures giving an effectual stimulus to this class of improvement would be of the greatest value to the country. The attention of the Commission cannot be turned to a matter of more importance." We quite agree with all Lord Lytton says, but the attempts to which he refers, as having been made to improve the native system of agriculture, have been misdirected. They have never had the slightest chance of attaining their object, nor has Government taken sufficient interest in the matter, to make those attempts more successful. It is not enough to have the mere will to do a thing, there is required also the knowledge of how to do it, though an earnest will go a long way and is half the battle; but we have never had that will, and if the famines of the last two years have really roused and determined us, to do something for the improvement of the condition of the agricultural population of this Empire, these famines will prove to have been a blessing to India.

Among the chief attempts to improve the native practice of agriculture, we suppose, Lord Lytton includes the creation of a Ministry of Agriculture and the establishment of Experimental Farms. Regarding, the former we do not desire, to add much to what we have said in previous issues regarding it. The Department of Agriculture, Revenue, and Commerce has, as far as agriculture is concerned, utterly failed to achieve anything worthy of note · it has failed to introduce any improvements of a permanent character, during the seven years of its existence. When the new department was created (in 1871), the press was unanimous in condemning the fusion of three important Departments into one, and the general conviction was, that any endeavours made by the Department to improve our Agriculture, the ostensible object of the new appointment, would be ineffective. The *Pioneer* expressed itself very pointedly, and as experience has shown correctly on the subject.

> We confess, said our contemporary, that, while admitting the convenience and necessity of adding to the Secretariat staff, so far as the progress of agriculture is concerned, we look forward to the measure without any hope at all. When all the various subjects enumerated by the Government of India have been made over to the new office the head of the department will find little time to take up a new line of duty for himself, and if agriculture is to be improved, he must take up a new line. The idea that any real good can be done by collecting unreliable statistics and writing reams of reports is puerile. The work to be done requires a man of practical experience, who will go about the country, see what is required; know how it ought to be done, and have power to do it. Now, even if such a man was at all likely to be made a Secretary, the duties of the office would be incompatible with this kind of work. He would find himself thrown into the middle of a mass of work handed over to him from other departments. Desk-work for eight or ten hours a day would leave him little time for original enterprise. The administration of land revenue, settlements, surveys, all laws and customs connected with agricultural industry, all questions relating to commerce, the opium and excise revenues, the forests, the salt and inland customs, and all matters connected with the census and emigration, are a few of the subjects to be entrusted to the new secretary. The list of them reads like an enumeration of nouns substantive in the *propria quæ maribus*—so utterly unconnected are they and so devoid of any logical relation to each other. The new secretary will be "not one, but all mankind's epitome," if he is able to do justice to half of these matters. But where are we to get a man who, besides doing all this, will be able to take up the entirely new work of promoting the agriculture of India in a practical and efficient way?

There were plainly four great questions which awaited the new Minister of agriculture; *the first* was, to deliver the ryot from the hands of the village usurer, if possible by establishing Government agricultural banks; *the second*, to stay the waste of manurial substances in village and town; *the third*, to provide the ryot with improved agricultural implements suitable to his condition and that of his cattle, and induce him to use them; and *the fourth*, to introduce new and valuable agricultural products, and to improve the native staples by growing them under the most favourable circumstances, aided by continuous selection of seed.

We knew then, as well as we know now, that our *system* of collecting the revenue in cash had thrown the *ryots* into the hands of the money-lender, and that the majority were hopelessly indebted and living from hand to mouth. We knew then, as well as now, that three-fourths of the farmers are compelled to borrow their seed at ruinous interest; that the revenue assessment is advanced by the village *bunniah*, who seldom takes less than thirty or forty per cent. for his money, and that on good security; and that crops are sold, disadvantageously to the cultivator, before they are harvested, and often before they are sown.

We knew then, as well as now, that the pernicious waste of manurial substances, in village and town, has been gradually improverishing the shallow stratum of soil, which the cultivators have been scraping for centuries past; that deep cultivation would double and treble the ordinary outturn of the Indian soil; and that vast improvements in agriculture could be effected by introducing new and suitable products, and by a steady and continued selection of seed for the native staples.

But seven years have gone, and we are not a step nearer to the improvement of Indian agriculture. We are still demanding a Minister of Agriculture, to preside over a Department, capable of working in the direction we have pointed out. The Experimental or Model Farms, established under the Government policy of self-support, have been a failure, as far as concerns their usefulness to the districts in which they are situated. It is true there are only a few of these experimental farms, if we consider the vastness of the Empire, but few though they are, they might have been useful to the country at large, but for the policy of Government which forces the superintendents to devote their time and attention to crops calculated to make the farm pay its own expenses, instead of devoting their time to the improvement of the agriculture of the District, in which their farms are situated.

We cannot do better here than give an extract from a demi-official letter on the establishment of Model Farms in India, penned by Mr. Hume, the first incumbent of the new appointment of Secretary to Government in the Department of Agriculture, Revenue and Commerce. The letter is dated Simla, the 2nd November 1871. Mr. Hume says:—

> "Briefly, what I contemplate is at least one large Government Model Farm in every district of the country, where all existing staples shall be grown, at first in the most approved local native fashion, and year by year on improved and ever-improving systems, and from seeds year by year improved by selection, and, where necessary, by interchange with other similar farms, where cattle, sheep, and poultry-breeding shall be cautiously, but perseveringly carried on, and where locally unknown staples and breeds should be gradually introduced, acclimatized, and popularized. The whole of these farms should be closely connected with each other. Their supervisors encouraged not only to vie with each other in results, but to visit and communicate with each other in the freest manner possible. Liberal prizes should be offered for those supervisors who make their farms pay best, and, besides these, provincial exhibitions should be held with numerous prizes for excellence of produce, whether agricultural or animal, equally open to the farms and to the agricultural population generally. A special Agricultural Journal should be started for the record of all done at these farms, all experiments, all failures, all successes, so that all might know what all were doing and so profit mutually by each other's experience.
>
> With due care in the selection of the men to begin with, it would be impossible under such a system, but what some man possessed in an eminent degree of all the capacities requisite for the development of agriculture, should be evolved, and real and important progress effected.
>
> Directly it became, on the whole, an acknowleged fact amongst the people of any district (and the people have eyes as well as we have and can appreciate good crops and better methods of tillage just as well as we can when they *see* them) that their model farm was really growing better crops, or growing crops similar to their own, cheaper, or breeding better stock, or turning out better seed than they were themselves able to do; sons of well-to-do cultivators, peasant-proprietors, and the like, who concern themselves personally with practical agriculture, should be allowed and invited to reside at the farm, and familiarize themselves with the system there followed, and the methods of caring for the stock there bred. All that showed capacity and intelligence and deserved it, should be furnished, at cost price, with improved seed or stock to start with on their own lands.
>
> Each farm should, in fact, become at once a practical school of agriculture and a source of supply of improved "material," whether vegetable or animal.
>
> This is, not an Utopian idea, it is susceptible of being carried into practice, if we only act boldly and judiciously, and on a sufficiently large scale. Nor is it sufficient to assert that it will repay indirectly many fold the expenditure incurred; my contention is that in the long run it will directly and fully repay its own expenses.
>
> The great difficulty, it will be said, will consist in obtaining supervisors, and at *first* starting this is unquestionably *the* rock upon which the adventure would be most in danger of shipwreck.
>
> But it must not be supposed that I contemplate starting all these farms at once. I would select a single division of, say six districts, and in this start six farms To each supervisor I would give two, three or four apprentices, intelligent youths, Country-born, English, Eurasian, Native, some of whom would, probably, become in time qualified to take charge of farms in other districts, under the supervision of their trainers, who, as time went on could manage, especially near lines of railway, two or even three farms each, I would also, from time to time, bring out young men of a higher class, who after a year or so training, acquisition of the native languages, &c., would be competent to assume independent charge of farms, and undertake the training of apprentices, &c. Thus the scheme would grow and spread until the whole province was covered. Doubtless, once it was fairly started in one province and established as a success in a single division of that province, other provinces would desire to make a similer commencement. Some fresh men would have to be got out from Europe, some would be spared from the first province in which the scheme was started, so that in ten or twelve years we might hope to have covered the whole Empire.
>
> But still the selection of the first men will be a most difficult matter. We require not merely a certain amount of scientific agricultural training, not merely a certain amount of practical knowledge as farmer and stock-breeder, but a strong healthy physical frame, energy, and industry, and a mind so far generally cultivated, that it shall be capable of adapting itself to new combinations of circumstances, of applying its experiences to these, and thinking out for itself the new problems, that will inevitably arise.
>
> Some such men *are* to be met with, and might be enlisted in our service, if we paid them fairly to begin with, made them clearly understand that their promotion or increase of salary depend on their success, and held out to them the certainty of a considerable share in any net profits realized, when once their farm had cleared itself of debt.
>
> It must be borne in mind that I base my hopes of success on the large scale of my proposed operations. Many of our men would, doubtless, turn out average good creatures, incapable of *originating* any important step of progress; but with a number, carefully selected to begin with, with emulation-prizes to gain, free inter-communication of experiences and ideas, and prospects of solid rewards, it would be impossible that here and there some man suited exactly to the needs of the country should not be developed, and one such man in a province, or in the Empire even, would leaven the whole."

Now, it must be admitted that Mr. Hume's letter was well conceived, and that farms, established on such a basis, would have done a great deal of good to the country, but Government took little or no interest in the matter, and the scheme was, we suppose, allowed to die itself. There was one weak point in Mr. Hume's suggestions. Experimental farms can never be made to pay their own expenses, if they are to be *experimental.* A certain sum of money must be set aside for their maintenance year after year, and whether they are a success or not, must be decided by the agricultural condition of the districts in which they are situated. The Superintendents of these farms should devote themselves in the first instance to the improvement of the agriculture of the District, and their labours should be judged by the improvements in *native agriculture,* they succeed in introducing into the District. There is not the slightest doubt that Government Farms must be the centres from which to introduce an improved system of agriculture into the country, but experience has shown that we cannot do so by making these farms, *model* farms, to which the peasant is invited to come and admire the *sahib's* crops, and learn how to do likewise. The character and disposition of the cultivator are such, that he will rarely come to the farm, and still more rarely will he enquire as to how the superior crops were raised, and even if he does, he will not adopt the same system, persuading himself that he, a poor man, cannot afford to grow crops as the *Sircar* does. We would therefore have Government farms for each agricultural district, but we would have no *model* farms. We would devote the land of Government farms in the first instance, to the growth of the chief agricultural staples of the district, whether cotton or wheat, jute or rice, tobacco or sugarcane, potatoes or jowar. We should grow these crops on the most approved principles of rational agriculture, on deeply cultivated soil, and with the aid of such manures as are available in the district. We should note the effect of the different manures, and the ultimate result of their application, The agricultural implements used in the Districts, we should endeavour to get improved in such a manner, as to enable the ryot and his cattle to cultivate deeply, and well. Once known what system of cultivation and what manure were most suited to a certain staple, in a certain district, the Superintendent of the farm should induce the most intelligent of native farmers to cultivate a portion of their land on this improved system, he undertaking on behalf of Government, to indemnify them for any loss they may incur.

If the interest of say half a dozen native land-owners in different parts of the district were thus engaged, and the new system and the improved implements were introduced successfully on their own farms and by the labour of their own servants, we could then, through the medium of these men, reach the masses; we are convinced, not otherwise.

The Government farm should be utilised to grow year after year, the chief staples of the district, on such a system as had been found most successful; the seed should be carefully selected year by year, and the surplus distributed throughout the district. These farms should be seed-depôts and devoted to the permanent improvement, by careful selection of seed, of the principal staples of the district, and only after no further improvement of the native staples was possible, should we endeavour to introduce new products.

These farms should likewise, as Mr. Hume says, devote themselves to improve the breed of cattle, sheep, and poultry, cautiously, but perseveringly, and they should be centres from which unknown staples and breeds should be gradually introduced, acclimatized and popularized; and the success of such a farm should be judged by the *visible* improvement of the agriculture and the agricultural products of the district, in which it is situated.

As we said, we would have one farm, and one superintendent, assisted by half a dozen apprentices, for each distinct agricultural district, but these farms must be all under *one* man, there must be *one* directing mind, and each year's operations, for each farm, must be decided the year previous.

All these farms should be under the unfettered control of the Minister of Agriculture, who in conference with the superintendents, would decide what agricultural experiments should be tried. Such a scheme will cost money, but we are paying now extra taxes as insurance against future famines, and to what better purpose can this insurance money be devoted than to *the Improvement of Indian Agriculture and of its Staple products?*

II.

The Resolution of the Government of India, which supplements and amplifies the despatch of the Secretary of State as to the Famine Commission, enforces, we are happy to see, with proper emphasis, the duty of the Commissioners to consider "how best to stimulate the agricultural wealth of the country." This really appears to us the more vital of the two great topics with which the Commission will be occupied:—the relief of the population in times of famine, and the modes in which famines may be prevented, and the population be better prepared to confront them. This latter object can be achieved only by the raising of the great agricultural class; and to accomplish this we must utilise as far as the conditions of the country make it practicable, those improved principles of agriculture, which the diffusion of physical science and centuries of European experience have brought within our reach. To grasp the results of this experience, to ascertain in what particulars, and subject to what limitations it is available for India, and to bring it within the reach of the ignorant, helpless masses, who blindly till the soil of this vast Empire, will be, in our opinion, among the most important of the many important tasks of the Famine Commissioners, and upon the proper fulfilment of which, so much of the future welfare of the country depends. It is of immense importance to deal with an existing famine in a humane, reasonable, and efficient manner; but it is still more important to the general well-being of the people, to put them in a position in which famines may be endured with comparative impunity, and their results curtailed within the narrowest limits. Nothing, we believe, is more essential in seeking to do this, than improved agriculture; and the Commission will, in our opinion, grossly fail in its duty if it does not contribute materially to place the agriculture of this country, on an altogether different footing from that which it at present occupies. The poorer the ryot is, the more necessary is it for him to have every help that science can give him, and the less can he afford to indulge in that most extravagant of all luxuries—ignorant conservatism.

How far the agricultural masses of India are from what they might easily be, how many opportunities of wealth they throw away, how costly and wasteful are many of their habits and contrivances, is admirably exemplified in the Report, furnished by Mr. Robertson, the Superintendent of the Madras Experimental Farm, of a tour which under the orders of Government, he made through the district of Coimbatore in the spring of 1876 and which formed the subject of an article in our issue of January last. Out of two millions of acres, the rent-paying area of this district, Mr. Robertson found only 5,000 devoted to village plantations; yet such plantations would, as he points out, not only tend to improve the rainfall, but would be invaluable in providing fuel, and thus preventing the consumption of manure for this purpose. By way of remedy, Mr. Robertson suggests, that the Government should establish a number of camping "topes," which might encourage the ryots in tree-planting, would give useful hints for its successful prosecution, and would in time be remunerative. No less than 700,000 acres of jungle or grass have, within the last 18 years, been brought under the plough, and there seems no doubt that there has been a serious diminution in the rainfall. One question to which the Famine Commission might with great propriety address itself, is the possibility of Government rendering the cultivation of a certain number of trees obligatory on its tenants. Such a condition might, we presume, be introduced in a settlement; and India, as Mr. Robertson says, appears to be the only country in the world where the landlord makes no stipulation as to the mode in which the tenant shall treat the soil, and the means which he shall adopt for the preservation of its productive powers and for its general improvement. Another matter which seemed to him to call for Government interference, was the insanitary condition of the villages. Few had any proper supply of drinking water; in none were the ordinary conditions of health observed, and the state of the population was exactly what might be expected. The ryots lose, it is reckoned, on an average from 4 to 6 week's labor by illnesses which are distinctly attributable to bad sanitation. Four weeks' wages to an agricultural laborer may make the difference between comfort and poverty, and the Famine Commission, one of whose main duties it is to suggest means "for putting the people in a better condition for enduring famines," will of course treat this important, though homely, topic with all the attention it deserves.

The Cauvery, Bhowany, Ambravutty, and various minor streams and tanks irrigate some 106,000 acres: of this area only 88,000 acres pay rent to Government, but this rental is one-fourth of the entire district, averaging Rs. 7¼ per acre against 14½ annas, the average rental of dry land. Mr. Robertson believes that this irrigated area might be largely extended, and a vast map of surface drainage, which now finds its way to the Cauvery, be rendered available for the agriculture of the district. He repeats a complaint, which he has often urged before, against the wasteful manner in which the ryot, when he has full command of water, invariably uses it. At present the ryot pours over his crop of paddy, in the course of five months' culture, a volume of water twelve feet deep. Mr. Robertson believes that, with proper cultivation, one-third, or, at the outside half, of this amount would produce equally good crops. But then much additional labor and expense would 80 to be incurred. The 3¼ millions of gallons, which Mr. Robertson reckons the Coimbatore peasant now pours over an acre of paddy, contain probably two tons of silt, to say nothing of potash, derived from the felspar rocks in which the streams rise, and carbonic acid gas derived from the rank vegetation through which they flow. A diminution of water would consequently imply a diminution of fertilizing substances, which would have to be otherwise supplied. But as water is scarce in Madras and manure plentiful, the employment of the one in the place of the other is a remedial measure which certainly deserves consideration. The water now employed in producing an acre of paddy would, Mr. Robertson calculates, under proper management, produce 4 or 5 acres of wheat or maize, each acre of which would be as valuable for food purposes as the acre of paddy. The high price which the right of occupying this irrigated land commands (sometimes as high as Rs. 250 per acre), convinced Mr. Robertson that the Government demand, ranging from Rs. 9 to 13 per acre, was not excessive. As to wells, Mr. Robertson makes a highly important suggestion. There are at present about 50,000 wells in the district, irrigating some 150,000 acres : this number might be vastly increased, but for two causes. One is that the provisions of the Land Improvement Act are very little known to the peasant, and very little pushed by the district authorities (a complaint which the revenue statistics prove to be unfortunately too well grounded) ; the other, that the peasant cannot afford to run the risk of digging down to the level at which water should be found, and then being unsuccessful. At present he has no machine for guaging the land, and is guided in his selection of a site by the babyish devices of the village conjuror, who, of course, as often as not, leads him astray. Mr. Robertson suggests that the Government should supply well-augers for boring purposes, and officials whose business it should be to point out likely sites for boring. The expense thus involved might be met by a slightly higher percentage on loans under the "Land Improvement Act." Somehow or other the Government ought surely to neglect no opportunity of arming the country with this excellent preventive against the effects of drought. Wells of course are liable to fail, but on many an occasion when they do not fail, they make the whole difference between plenty and destitution.

Another highly important topic in connection with well-irrigation, is the probability of improved means of drawing water. An improved waterlift, "the double mhote" which has been introduced at the Madras Experimental Farm, reduces the expense of the process by about one-half. According to Mr. Robertson's calculations, the irrigation of an acre with the old-fashioned water-lift, costs Rs. 2-1-3, and with the improved machine Re. 1-1-1. As many crops receive from 10 to 12 waterings, and as there are 150,000 acres under well-irrigation, the saving effected by the adoption of the improved machine would be equal to the entire State rental of the district. We are happy to learn that the double mhote water-lifts are being introduced in the town of Coimbatore, and elsewhere in the district. Such improvements, humble as they seem, lie at the very root of a country's agricultural prosperity, and it will be for the Famine Commission to verify their work and popularize their employment. Another matter to which Mr. Robertson calls attention is the danger arising from the constant increase of the area under cultivation, owing to the pressure of the population on the soil. No less than 700,000 acres have been thus brought under culture within the last 18 years; most of the land is inferior soil ; the occupiers of it are not among the wealthiest or most enterprising classes ; the mode of culture followed is of the most inferior order, and the consequence is the creation of a body of ryots hardly ever removed above distress, and liable at the first pressure of famine to sink into complete destitution. Nothing but improved agriculture, urges Mr. Robertson, can render land of this description anything but a source of danger to the State, inasmuch as its occupants may at any moment require to be rescued by State aid from the disastrous effects of the first climatic influence which happens to be unfavorable. Nor is this the only danger. The incidence of the revenue is, it appears, such as to discourage, and indeed render impossible, the continuance of land under pasturage. Formerly grass lands were rated at one-fourth of the rent payable for arable lands : but now this rule is subject to the condition that no person is ready to break the land up for arable culture, and pay the full rent. The result is that no land, which can be utilized for culture, remains under pasture. Artificial pasturage, such as is the object of sedulous care to the English agriculturist, is unknown in India ; and the result has been a most alarming diminution in the proportion of cattle to the area under cultivation. Mr. Robertson reckons that whereas there were, in 1838, sixty-six cattle to every 100 acres of occupied land, there are now only thirty-two for the same area.

This of course means deficiency of animal manure and wholesale deterioration of the soil ; the deficiency again is aggravated by the habit of using cattle-dung for fuel. Mr. Robertson reckons that in many households the consumption of this fuel is equal to the product of one bullock for each adult. As no arrangements exist for restoring the refuse of towns to the soil, the whole of the manure so consumed is lost to the purposes of agriculture. Mr. Robertson suggests that Government should render the employment of manure obligatory on the ryot, and not allow him to rob the soil, by his ignorant neglect of the substances which are essential to successful agriculture. He would insist on a proportion, say 10 or 15 per cent., of the arable land being cropped with fodder crops, and he would seize every opportunity of utilising the refuse of the town, for the growth of fuel plantations in their neighbourhood. In Madras, he says, firewood costs twice as much as in England, and municipalities might not only benefit the inhabitants, but greatly diminish their own expenses, by providing an adequate supply of fuel at a moderate rate.

We heartily commend these and many other interesting topics of Mr. Robertson's Report, to the Commissioner's attention. They are the remarks and suggestions, not of an enthusiatic amateur, astride of his favourite hobby, but of one of the few professional agriculturists thoroughly acquainted with the special requirements of India, and the Commissioner will be bound hereafter to show either that they have adopted his recommendations, or that they have rejected them only after consideration and trial, and on the strength of still higher scientific authority. For this purpose, the presence of Mr. Caird on the Commission, will be invaluable.

THE AMERICAN ENTOMOLOGICAL COMMISSION.

ADVERTING to the locusts and other insect pests which are still damaging crops in Southern India, we drew attention in our last issue, to the report of an Entomological Commission which had been appointed by the United States' Minister of Agriculture, and was organised and placed under the auspices of Professor Hayden of the Geological Survey, for the purpose of investigating and reporting upon the entire subject of insect ravages in regions throughout the western portion of the United States. The reports of this Commission, we said, should now be available and of special interest to the Madras Government, which has we are glad to hear, authorised the Board of Revenue to obtain direct from America, ten copies of the reports referred to. In the meanwhile we place before our readers an extract from a recent number of "*Nature* on this very subject :"—

"The members of the Commission," says our contemporary, "have been busily engaged in the preparation of the several parts of their annual report, and will soon meet in Washington, where they will have a protracted sitting to get everything ready for the printer. This report is looked for with much interest by the farmers of the West, and the character of the Commissioners is a guarantee that it will be creditable from the scientific, and valuable from the practical stand-point. The Report will contain sixteen chapters under the following heads :—Introduction—Riley ; Chronological History—Packard ; Statistics of Losses—Thomas ; Classification and Nomenclature—Thomas ; Geographical Distribution—Thomas and Packard ; Migration and Meteorology—Packard and Thomas ; Original Permanent Breeding Grounds—Riley, Packard, and Thomas ; Habits and Natural History—Riley ; Embryology—Packard ; Metamorphoses—Riley and Packard ; Invertebrate Enemies—Riley ; Vertebrate Enemies—Thomas ; Remedies and Devices for Destruction—Riley ; Prairie Fires *versus* Locust Injury—Riley ; Agricultural Bearings of the subject—Thomas ; Ravages of other Locusts—Packard and Riley ; Locust Ravages in other countries.

These chapters will embrace many sub-chapters, and the report will be as exhaustive as the limited time for its preparation will permit.

In Chapter IV. the western extension and the northern and eastern limits of the species range are fully given.

In Chapter V. the laws governing its migrations are, for the first time, defined. A very large number of data have been collected in reference to the subjects of this chapter. Not only are the general laws governing the movements of the insect now defined showing a regular migration southward and return migration northward, which may be counted on and foreseen; but many important highly interesting facts in reference to their local flights are brought to light, which will henceforward form a part of the history of the insect.

In Chapter VII. several other laws governing the species are also adduced; and the importance of the discovery of the laws which regulate the doings and movements of the pest cannot be over-estimated. In said Chapter VII. many new facts will, for the first time, appear, and all that is definite and accurate be made known.

In Chapter X. many new discoveries will be recorded, some of them of great scientfic interest and importance. Of these may be mentioned the transformation of the silky mite (*Trombidium sericeum*). This is an eight-legged creature, which preys on the locust eggs. It is proved to be the mature form of the little six-legged mite (*Astoma gryllaria*) which is parasitic on the locust. Insects described under different genera are thus proved to be specifically identical. The life-history of the blister-beetles will also be given; their larvæ feeding upon locust eggs and undergoing singular changes called hypermetamorphoses. The interest attaching to this discovery among entomologists, as well as among farmers, is best appreciated when it is considered that absolutely nothing has heretofore been known of the larval habits of these blister-beetles, notwithstanding the fact that for half a century much attention has been given to the subject by scientific men on account of the commercial value of Cantharadis or Spanish-fly, and of the great injury to potatoes and other plants committed by several of our American species.

In Chapter XI. are given the locust-feeding habits of many Western animals not heretofore known to have that habit, and the good offices of birds are especially made manifest; examinations of the stomachs of over 90 species and 630 specimens having been made with special reference to their locust-eating habits. The record in reference to these examinations is very full, giving the dates, the locality, the common and scientific names of the species, and the number of locusts and other insects found in each. The value heretofore placed on these aids by entomologists is fully sustained by this record.

In Chapter XII. which will be one of the most extended and most important practically, it is clearly shown that the young locusts may be controlled, and by what means; while the way is pointed out how to better control the winged insects. Many valuable devices for destruction will be illustrated, among them one invented by Professor Riley, which gave great satisfaction, and will, it is believed, supersede all others as a cheap and practical remedy applicable at any season, whether the plants or the insects be small or large.

In Chapters II. and IV. are given statistics showing the immense losses inflicted on Western agriculturists by the locust. These chapters also show what crops are most liable to injury, what are most easily protected; also the best methods of cropping in order to reduce the injury to a minimum. A chemical analysis of the dead locusts has been made, and is usually interesting. The insects furnish a new oil which will be christened Coloptime, and a very large percentage of pure formic acid. Though this acid exists in the ant and some other insects, it is with difficulty obtained in large quantities, by the action of sulphuric acid upon the locust juices it passed off with great readiness and in remarkable quantity and gravity. The various uses of this acid, whether as therapeutic agent or as laboratory re-agents, &c., are capable of great and valuable extension when it can once be obtained so readily and in such quantity.

The report is expected to make about 500 pages and will, it is hoped, be published in February or March. Although the Commissioners have divided the labour among them, the report will form one complete whole, as the work of each will be discussed and revised by the Commission as a whole. The annual report, which is intended more particularly for the practical farming public, will be followed by memoirs of a more purely scientific nature—one by Dr. Packard on Anatomy and Embryology; one by Professor Riley on the Natural History of other locusts; and one by Professor Thomas on the Classification of the *Acridida*.

While it has been the object of the Commission to cover as much ground as possible, so as to make the annual report as full and valuable as the time would permit, there yet remain several important subjects that it has so far been impossible to properly and exhaustively study. The territory affected is so vast, embracing over a million square miles, that much of it was imperfectly explored, especially in the north-west. Mr. Riley had to cut short his investigations in British America, both for want of time and want of funds. For similar reasons, and on account of Indian troubles, Montana, Wyoming, and Dakata, have been but superficially explored.

The year 1877 was an abnormal year, *i.e.*, the insect had the previous year overrun a large section of country in which it is not indigenous, hatched in such country in the spring. This was most fortunate for many reasons, as it enabled the Commission to carefully study the insects in this their unnatural condition and to carry on experiments with a view of learning how to control them. Much of the work of the Commission was with these young insects. The losses sustained through the devastation of the pest by young and struggling frontier populations, ill-able to bear them, were immense; and there was so much discouragement that hundreds and thousands of persons were on the point of abandoning their new homes last spring. At this juncture, the Commission went into the fields, and by its encouraging predictions (which were all verified) and recommendations, imbued the people with hope and confidence, and drew westward again the emigration that had almost stopped, All this work, however, interfered with needed investigations into the proper range, the native home and breeding grounds. the source of swarms, and many other important questions which can only be properly studied during a normal year. It is, therefore, very important that the investigations be continued until every question is settled that human investigation can settle.

For the proper settlement of some of the questions, the co-operation of the dominion of Government is desirable, and has been promised by the Canadian authorities if the work of the Commission should continue.

It will be unwise to stop the work of the Commission before completed. The work should be made so thorough as to obviate any necessity in future years of creating another Commission for the same purpose. After careful estimates it is concluded that the work can be satisfactorily compiled only with two more years' investigation and experiment. The Commission, therefore, ask, for a continuance of the appropriation of 25,000 dols., asked for a year ago.

There are various other injurious insects of national importance of which much has yet to be learned, and in addition to completing the locust investigation, the Commission contemplate, during the coming two years, studying and reporting on some of these worst enemies to American agriculture. They are especially desirous of reporting on the cotton worm of the South, which, though often so disastrous to the cotton-crop, has never been fully studied, and in the mere Natural History, of which there are yet may mysteries and conflicting theories.

Much has yet to be done in giving practical form to the conclusions arrived at, and plans proposed by the Commission to enable the work already done to bear proper fruit. To bring about the needed co-operation of the two Governments, to cause proper laws to be enacted in all the States interested, and to enforce the truths that alone will make man master of the situation, is largely the work of the future."

Dr. Bidie writing on the subject says:

"As I observe that the United States' Entomological Commission, organized under Professor Hayden, of the Geological Survey for the purpose of investigating the ravages of insects on the continent of America is about to publish an annual report, I have the honor to request that His Grace the Governor in Council may be pleased to apply for one or more copies of the work for the Museum."

The report promises to be of great scientific interest and pratical value, as it will deal not only with the natural history of insects destructive to cultivated plants, but also afford information as to the best means of protecting crops from such pests.

Professor Hayden is most liberal in sending the publication of the Geological Survey to the Madras Museum, but in case the work now referred to should not be sent, it seems desirable to take the precaution of asking for a copy or copies of the forthcoming annual report, as well as the succeeding memoirs promised on the same subject."

TOBACCO CULTIVATION IN FRANCE.

IT was in 1811, under the reign of Napoleon, that the French Government first made the manufacture and sale of tobacco a Government monopoly. Previous to that date, French smokers, possessing but moderate means, had fared as ill as those of England and the United States do to this day. But one night, at a ball at the Tuilleries, the Emperor noticed a lady who was covered with diamonds. He asked his chamberlain who she was. On being told that her husband was a tobacco merchant who had made a colossal fortune within a few years, he at once suspected that a fortune built up so rapidly could have no very honest foundation. A few months afterwards he signed, in his usual arbitrary way, a decree which secured to the State the exclusive right of fabricating and selling tobacco. The monopoly has been renewed every ten years since by successive legislative bodies.

The Government has every interest to see that what it sells should be of good quality, in order, firstly, that the demand for the tobacco should be general; and secondly, that there should arise no suspicion of trickery or adulteration in the public mind. To this end, the supervision exercised over the tobacco manufacture is very strict. A director-general, responsible to the Minister of finance, is placed at the head of the administration, and all the subordinate posts of superintendence are filled by officers selected from the Ecole Polytechnique: which means that they are men of unquestionable capacity.

The number of the manufactories is seventeen; five hundred and twenty-four officers are entrusted with the management of the plantations and the surveillance of the manufactories. There are thirty-one store-houses; three hundred and fifty-seven wholesale warehouses; and thirty-eight thousand eight hundred and thirty-one retail establishments.

The tobacconist in France is an official. The post is in the direct gift of the Government, and is tenable only during good behaviour. He or she (for a great many of the holders are women) generally owes the appointment to the recommendation of the receiver-general of the district: the applicant is obliged to go through the form of drawing up a petition, which is submitted to the minister of finance, and signed by him on ratification. It is needless to say that the number of candidates to fill each vacant place is large. Owing to the limited number of tobacconists' shops, the business is very lucrative. The net profits of some of the shops on the Boulevards, range from twenty-five thousand to sixty thousand francs a year. The famous Civette, opposite the Palais Royal, is said to have yielded one hundred and twenty-five thousand francs (fifty thousand rupees) a year, but in the case of these well-situated establishments, it is not unusual for the business to be let and sublet half a dozen times, the titular owner being often a person of high position: the widow of a general officer, who has died poor: or often an old retired officer himself, who has rendered secret services, and must be recompensed otherwise than by promotion or the Legion of Honour. Every year introduces some new improvement into the system of preparation. Some scores of scientific men are continually employed—they are paid to do it, and to do nothing else—in studying new methods of ameliorating the culture of tobacco, improving the favour of the leaves, and so blending the different varieties as to form finer and more wholesome cigars. But it is in the making of snuff; that the French have attained rare perfection. The time required to turn a leaf of tobacco into snuff, according to the method of the "Regie" is four years and two months, a fact which speaks volumes for the care bestowed upon the fabrication. The "Regie" sells three kinds of tobacco for pipe-smokers. The best goes by the name of "Maryland." It is retailed in yellow packets, and costs five shillings (two rupees, eight annas) a pound. The second quality is called "Caporal," and is the most used, it costs four shillings a pound. The third quality is prepared for the use of soldiers only; it costs two shillings a pound; but it can only be obtained on presentation of a species of Government voucher, to one of which the soldier is entitled every ten days. Tobacconists are forbidden under heavy penalties, to sell this tobacco to civilians.

The "Regie" manufactures six or seven kinds of cigars. The best cost from fifty centimes (= about 3½ annas) to a franc (= about 7 annas) each. The large majority of Frenchmen know but five kinds of cigars: the Londres, Trabucos, Millares, Decimos, and Sontellas. Of these five kinds, the Londres is the best; it costs twenty-five centimes (= about 1¾ annas), and, if carefully selected, is fully equal to the Regalias, which costs six pence (=4 annas) in London. The Trabucos cost twenty centimes (= one anna, four pies), the Millares fifteen centimes (= one anna), the Decimos ten centimes (= eight pies). They are none of them bad, and are all far superior to anything that can be had elsewhere for the money.

The two principal manufactories are in Paris: at the Gros Caillou, where snuff and pipe-tobacco are made; and at Reuilly, where the higher class of cigars are manufactured. The task is entrusted in the latter establishment entirely to women, of whom there are as many as two hundred and fifty employed. A skilful work-woman can make from ninety to one hundred and fifty *Londres* in ten hours, and three hundred *Sontellas* within the same time. Not the least curious circumstance which strikes a visitor to the manufactory at Reuilly, is the total silence observed by the two hundred and fifty women; a whisper is punished by a fine; work is paid for by the "piece." The net profit, or revenue, derived by the French Government from this monopoly is about eight millions of pounds sterling per annum, or nearly as much as the Anglo-Indian Government derive from the sale of opium to the Heathen Chinee. The cost of manufacture is reckoned at about 25 per cent., equal to two millions sterling, which gives ten millions of pounds sterling, as the value of tobacco, under various forms, sold annually in France.

PROPOSED RAILWAY THROUGH ASSAM.

A PRELIMINARY MEETING was recently held in London to consider the following Memorandum drawn up by Messrs. Lister & Co., of Bradford, relating to improved communications for the Province of Assam:—

"To those acquainted with the conditions of the Tea Industry in Assam, there is no need to say that the crying want of the province is a sufficient supply of labor.

The present recruiting system, by which labourers are brought from Nagpore and other distant districts, is extremely costly, and quite fails to produce an adequate supply.

The present passage by steamer from Goalundo, the Northern Terminus of the Eastern Bengal Railway, to Dibrooghur, the farthest point to which the steamers go, occupies an average period of 20 days, though the distance is under 600 miles.

At present six steamers per month traverse the distance each way, but the traffic must, of course, increase in proportion to the increased area of ground brought under cultivation.

It is proposed to form a Railway Company to carry a Railway from the Rangpur branch of the Northern Bengal Railway, to follow the northern bank of the Bramapootra to the most convenient place for crossing the river, probably Gauhati, and thence by the south side of the river to Dibrooghur, the total distance being rather over 400 miles. The Government, in lieu of guaranteeing dividends, will be asked to make grants of land of considerable extent, on the principle of several of the American Railways.

It is further proposed to request the Government to extend the present Sudya-road through the Kampti, Singphoo, and Shan districts, to the Chinese Province of Yunnan, a distance of about 200 miles. The intervening tribes are very friendly, trading regularly with both China and Assam, when the dry season will allow them to use the beds of rivers as a road.

In this way there would becom plete communication between Calcutta and China, nearly four-fifths of the distance being covered by railroad. Chinese labour would then solve the perplexing question as to how to get coolies for Assam; and this and the ready outlet for her productions afforded by the railroad would doubtless greatly tend to the development of the province.

In addition to this, the opening up of south-west China would give a new and an enormous market for European goods which would thus swell the traffic of the railroad, and help to make it remunerative." The scheme generally has been regarded with favour by the Government, who now desire fuller particulars.

The whole subject was fully discussed, and it was resolved to call another meeting, to be held at No. 2, Jermyn-street, on Thursday, the 4th April, at 3 P.M., those present agreeing to invite other gentlemen, known to them as interested in the question, also to attend the adjourned meeting.

Colonel Hopkinson was requested to preside and Mr. Burrell to act as Honorary Secretary.

AN AUTOMATIC WINDMILL PUMP.

At a time like the present, when attention is anxiously directed to the storing of water, or its economical raising from rivers and wells, for the pressing needs of the people of India and its agriculture, any scheme that offers well-grounded hope that its application will answer this important end, should receive attention. We therefore publish the description of what appears to be a practical scheme for this purpose, the patentees of which claim for it that it will force water by compressed air to a great height and to any required distance.

The apparatus consists simply of a pneumatic pump for compressing air, worked by a substantial wind wheel, with sails of sheet iron and wood capable of withstanding the severest winds. The compressed air is conveyed from a cast-iron cylinder by a common iron pipe to the automatic force pump which is really the great feature of the machine. This force pump is to be always placed submerged in water at any required depth, and consists merely of two metallic chambers having each a plain valve opening inwards giving free admittance to water from the well or tank. The stream of compressed air conveyed through the above pipe as already described passes down into the chambers in the water, shutting the valves by direct pressure, and forcing the water up through a pipe larger than that used for the air, and to such distance as may be desired. The discharge of water is in a steady, continuous stream, as the compressed air acts only on one chamber at a time, thereby affording the chambers an opportunity to refill alternately with water and to open up by their own increased weight a connection with the air pipe. The whole contrivance is exceedingly simple, and does away with the friction and wear incident to the use of pistons and buckets. The windmill admits of being placed in any exposed position, however distant from the water that is to be raised, and adjusts itself by a rudder to face any quarter from which the wind may chose to blow Besides, when there is a calm the action of the windmill may be readily kept up—a feature most favourable and peculiar to this machine alone—by a couple of coolies interposing a belt and wheel, and by means of a crank attached to the latter, adopt the multiplying process.

The machine can be erected in a day or two (some have been put up in a few hours) without any special engineering skill, and requires no attention save that of oiling once or twice a month.

It has but recently been patented under the name of the "Hartford Automatic Windmill Pump," manufactured at Hartford, Connecticut, United States of America. We learn that one of these pumps has been ordered for the Khandeish Experimental Farm.

EDITORIAL NOTES.

We shall be obliged to the officer in charge of the Nagpore model farm, for particulars of the action of lime as manure for sugarcane, mentioned in the last monthly report. Particulars should include, quality of soil (clayey, loamy, or sandy), previous history of the soil as far as known, especially with regard to what manures have been used in the preceding three or four years and the quantity per acre. Further what quantity of lime has been used, and when put into the ground, and lastly weight of sugarcane obtained per acre, and the quantity and quality of *goor* obtained. If these monthly reports are to be of any use to the Indian agriculturist we must have all the details of such agricultural experiments as are being conducted.

The Agricultural College at Madras is becoming, we rejoice to see, a great success. We felt sure that Mr. Robertson would make it so. There is a natural reluctance to admit that we owe the severity of these famine calamities largely to our total neglect of the agriculture of the country; but we observe that this conviction is slowly obtaining its way into men's minds. It is Mr. Robertson's conviction, and he has submitted a scheme to the Madras Government, for taking up the whole presidency as a field for the College. The Board of Revenue and the Madras Government are both, we hear, favorable to Mr. Robertson's scheme, the chief feature of which is the establishment of Agricultural Schools in all the districts, as feeders of the College, the districts being worked in groups under European professional agriculturists. The Agricultural College is also to be placed on a thoroughly efficient footing. Some 29 students attended the winter sessions of the college, which ended on the 30th April. At the examinations, and out of a total of 3,136 possible marks, the following students attained the very high numbers attached to their names :—

N. H. Patuck	2,808 marks.
C. K. Sabba Row	2,780 "
G. Krishna Prabhu	2,713 "
P. D. Moody	2,698 "
R. D. Tata	2,579 "
K. M. Nagger Row	2,473 "

Three of the six thus appear to be Parsee lads; the second, third, and sixth Hindoo. Of the whole 29 students, about 24 seem to be Madrassees, and the remaining 5 Parsees; and the very high places obtained by three out of the five speak very highly for their character.

Agricultural education is, there can be no doubt, an important step towards the improvement of Indian agriculture, but we must not forget that we shall not and cannot reach the *masses* of the native cultivators through lectures in class rooms, nor through *Government model* farms; we must educate them by showing them the results of an improved system of agriculture on their own farms, and by letting them take part in the *modus operandi* by which these results can be obtained. The farms of the most prominent land owners of any particular district must be made model farms, if we would really educate the masses.

The success of the College will not lie in the number of marks its pupils attain at periodical examinations, which simply shows their diligence and power to commit facts and dates to memory, but in the work of the pupils after they have left College. If we find these pupils settling down as cultivators and carrying out in practice what they have learnt in College, then indeed the Agricultural College of Madras will prove a blessing to the country.

Referring to the pests of insect life which have so frustrated the hopes of abundance of food in Madras, Dr. Cornish mentions that the country all about Darampuri in Salem was in the middle of March covered by grasshoppers of many kinds and species, and that in stubble or grass land, where there is apparently little or nothing for them to eat, every footstep sends swarms of them hopping into the air. "In all my experience of India, I have never seen anything like the abundance of grasshoppers, and I can well understand the very general complaints of the damage done by them."

Regarding the 'blight', in the Cuddapah District, the following observations of Dr. D. D. Cunningham, Special Assistant to Sanitary Commissioner, with the Government of India, have been recorded :—Herewith I return the papers sent along with the blighted cholum from Mr. Weekes. The specimens consisted (1) of heads affected by a species of "Ustilago ;" (2) of heads which had been attacked by insects and secondarily affected by the conidial form of some Pyrenomycite, probably a Phospera. The spores of the Ustilago were characterized by their very small size and the great thickness of Epi-spore. The grains which had been attacked by insects were eaten across, and the exposed section was blackened by the filaments and conidia of the secondary mould. The blackening was quite superficial, and this, together with the nature of the fungus, clearly showed that the fungal development in this case was a consequence, not a cause of the injury to the grain.

We understand that 500lbs. of good Orleans cotton seed has lately been despatched by the Home Government to Bombay. American cotton seed seems to have lately considerably advanced in favor with Indian agriculturists. The Collector of Khandeish especially, commends the excellence of the product from the American Dharwar seed, which he considers will soon beat the indigenous or Hingenghat cotton, out of the market.

The past harvest at Nagpore has proved a very short one, as respects all *rabi* crops Chenna was so short as to command a higher price in the market than wheat; and the vetch tribe generally is in the same condition. Wheat is so much spoilt as to necessitate resort to other quarters for next years' seed.

At Khandeish the outturn of jowari this season, is about a quarter below a good average crop, but on account of the abnormal condition of rates and prices, the money-value is considerably higher. At the experimental farm, the total outturn per acre was 180 seers against an average of 230 seers; but the value of crop per acre was Rs. 21-9 as compared with the average of Rs. 15. The Superintendent of the Khandeish Experimental Farm, reports that there is an enormous demand this year for acclimatized American cotton seed. On account of the failure of the Khandeish cotton crop, there will be unfortunately little of the farm seed available for distribution.

We learn by private advices from Chittagong, under date of 15th instant, that the high prices now ruling there, have put an end to exports for the present, and that shipments may now be considered over until the next season. The gross rice and paddy exports are a little over those of last season, but are still low, owing to the poorness of the first crop, and the fact that the local consumption prevented all export before December. The unhappy events of the past few years appear however, to have produced a satisfactory effect on the cultivators by inducing them we are told to abandon some of their old proceedings. They have tried this year to make use of the water of the river, where irrigation is practicable, for sowing grains at an early date, instead of waiting for the rains, as they formerly did. There is now in the neighbourhood of Chittagong, a certain extent of ground in which the paddy will be ready to be gathered within a few weeks. This is a step which gives hopes of seeing the general production of the province largely increased within a short period. Fertile and well watered as they are, the districts surrounding Chitta gong ought to provide throughout the year, exportations from the port. Jute and other produces of Eastern Bengal will, it is expected, shew early and great activity.

Chuprah, Chumparun, and Tirhoot, have all been visited with more or less partial rain during the last week, some places getting as much as four inches, and both planters' and ryots' prospects are thereby considerably improved.

At the meeting of the Indigo Planters' Association held on the 15th ultimo at Muzufferpore, Mr. T. Gibbon was voted to the chair. Three candidates only were proposed for election to the post of Secretary. Mr. W. B. Hudson of Chumparun, proposed by Mr. McLeod, Mr. W. Mackenzie of Tirhoot, by Mr. Wilkinson; and Mr. T. M. Francis, Solicitor, of Mozufferpore, proposed by Mr. Abbott. Mr. Hudson was eventually elected by a large majority.

We hear from Darjeeling that so far the *bhoota* crop looks exceedingly well, but some of the cultivators are considerably alarmed at the appearance of, to them, a new enemy of the plant. It appears to be some sort of borer, and is doing a considerable amount of damage.

We hear that the success of Mr. Harman at Bangalore with deep cultivation last year, has induced him to make further attempts in the same direction. By means of a subsoil plough, working behind an ordinary light English plough the soil is being stirred to a depth of fifteen inches. The first plough turns over a furrow eight inches in depth, after which the subsoil plough follows in the same line and stirs another seven inches, clay, but does not bring it to the surface, where, if it were clay, it might be injurious to the young seeds when they commence to sprout. A pair of bullocks is used with each plough, and drags them for nine hours a day with the greatest ease. We look forward with interest to the result of this simple experiment to mitigate the evaporating effect of a tropical sun.

Settlement operations in the Ludiana, Hushaiarpur, Sirsa, Jullundhur, and Umballa districts will shortly be commenced, the local Government having sanctioned the settlement. The Ludiana district operations will be commenced in a few weeks, and we understand that Mr. T. G. Walker at present Assistant Settlement officer at Multan, will be appointed to the charge of this settlement. At the end of the current year, the settlement of Hushiarpur (that is to say those *tehsils* as yet unsettled), Sirsa, and a portion of the Umballa district will be started. Lieutenant Montgomery will in all probability be placed in charge of the work of the Hushiarpur district; while that of the Sirsa and Umballa districts will be entrusted to Messrs. Wilson and Steedman, respectively. The settlement of the Jullundhur district, and the rest of the Amballa district, which will also include, we believe that of the Thanesar sub-division of the Kurnal district, will not be commenced till late in 1879, or early in 1880. The officer in charge of the Amballa settlement will, we believe, be allowed an extra staff of assistants owing to the extent of the work that will be required of him. It is believed that operations in the Bannu, Dera Ismail Khan, and Gurgaon will be finished this year, while those of Delhi, Kurnal, Kohat, Mozaffargarh, and Multan, will probably occupy the officers in charge till the end of next year.

Mr. R. M. Dane, it is understood, will probably remain in charge of the Jhelum settlement, as it is most unlikely that Mr. Purser will again return to that district.

The annual report on the administration of the Cotton Department for 1876-77, furnished by the Bombay Government, was forwarded in Junuary last to the Secretary of State, who, after a a careful review of its details, remarks:—"It was not to be expected that a favourable report could be submitted in a year during which famine prevailed to a calamitous extent, but it gives me pleasure to express my opinion that the report shows that all the officers of the department have, under seriously adverse circumstances, worked with an energy and ability which deserve my commendation." The total area under cotton cultivation was 3,232,744 acres, being a decrease of 1,283,843 acres on the previous year's returns. This decrease is exhibited in every division of the Presidency except Sind, in which there was an increase of 16,177 acres. The falling off is chiefly observed in the Southern Division, in which it amounts to upwards of a million acres. Of this the greater part represents the decrease in the Southern Mahratta country, *viz.*, 985,230 acres. In other collectorates, such as Ahmednuggur, Poona, Satara, and Sholapore, the area under cotton fell from 118,767 to 50,301 acres. In the Northern Division there was in Khandeish a decrease of 106,258, and in Surat one of 2,846 acres, but increases in other collectorates reduced the net decrease to 103,404 acres. In Native States there was a decrease 142,920 acres. The decrease in the outturn of the crop is shown by the following figures:—

1875-76	Cwts. 2,142,835
1876-77	„ 1,603,099

In Sind there was an increase of 35,666 cwts. The bulk of the crop is stated to have been of good quality. The exports during the year amounted to 952,827 bales, of the declared value of Rs. 9,02,60,143, showing a falling off in comparison with the previous year of 67,457 bales, and of Rs. 7,51,195 in value. The return of the year is, in fact, worse than that of any year except 1866-67.

We are sorry to hear that the experiments in tobacco planting undertaken by some enterprising tea-planters in the Kangra valley are not likely to be attended by any definite results this year caterpillars having in multitudes attacked the plant.

MISCELLANEOUS NOTES.

Mr. J. M. A. MONTCLAR, Civil Engineer, residing at Trevandrum has filed, under the provisions of Act XV. of 1859, in the Office of the Secretary to the Government of India in the Home Department, a specification of a new scientific agricultural application for improving coffee, tea, cinchona, or any other cultivation now in existence, in the stiff hard soil of the steep lands in the hilly ranges of India and Ceylon, but especially when opening a plantation from the beginning.

We understand that the Government of India, forwarded to the Secretary of State, in February last, reports from the Governments of Madras and Bengal on the experimental bonded salting enclosures for fish-curing operations in those Provinces. The experiments appear to have been especially successful in Bengal and the Secretary of State has approved of their continuance.

A CLEVER French entomologist has lately made great efforts to naturalise the *Bombyx cynthia*, or silkworm of the Japan varnish tree. His perseverance seems likely to be crowned with success, as it has thriven in the open air in the Bois de Boulogne. The *ailanthus* or varnish tree, whose leaf serves it for food, proves, to be very hardy, and easily propagated, it grows in almost every soil, and vegetates under very unfavourable condition as those planted on the Boulevard des Italiens do not suffer from the subterranean emanations of gas or the dust of macadamized roads.

AGRICULTURAL prospects in the Straits Settlements, if we may believe the *Penang Gazette*, would appear to be only less gloomy than in many parts of India. The *Gazette* says: "Serious indeed appear to be the agricultural prospects, both on this as well as in the neighbouring settlements, owing to the prevailing drought. From all sides we hear of nothing but the scarcity of seasonable rains, and we fear that unless there is a change in the weather before long, that the consequences will be serious." In this state of affairs, attention is being directed to the manner in which the hills, both in Penang and Province Wellesley, are being denuded of their forests. There can be no doubt that there has been a heavy decrease in the rainfall, both in Penang and Province Wellesley during the last few years; the *Gazette* is urging the Government to put a stop to any further destruction in these settlements.

LOCUSTS IN INDIA.—A writer in the "Asiatic Journal" gives the following account of a swarm of locusts that visited India in 1812:—

"About the 20th June 1812, a very large flight of locusts was observed hovering about Etawah, which at length settled in the fields east of the town, where they remained some time, and were seen breeding in vast numbers; they then took their departure, but continued to hover about the place for a month afterwards. On the 18th of July, while riding in that direction, I discovered a tremendous swarm of very small dark coloured insects in the vicinity of a large pool of stagnant water: they were collected in heaps, and covered the ground to a considerable distance. These, on minute inspection, proved to be locusts in miniature but without wings. In this place they remained, hourly increasing in numbers, for some days, when the great body moved off, taking a direction towards the town of Etawah: they creeped and hopped along at a slow rate, until they reached the town, where they divided into different bodies, still, however, keeping nearly the same direction, covering and destroying everything green in their progress, and distributing themselves all over the neighbourhood. The devastation daily committed by them being almost incalculable, the farmers were under the necessity of collecting as many people as they could, in the vain hope that they might preserve the crop by sweeping the swarm backwards, but as often as they succeeded in repelling them in one quarter, they approached in another; fires were then lighted all round the fields with the same view—this had the effect of keeping them off for a short time, but sufficient fuel could not be supplied, and the moment the fires became extinguished, the insects rushed in like a torrent. Multitudes were destroyed by the birds, and many more by branches of trees, used by the farmers for that purpose, as well as by their being swept into large heaps and consumed by fire, yet their numbers seemed nothing diminished. They so completely covered some mangoe trees, and the hedges surrounding the gardens, that the colour of the leaves could not be distinguished. They had no wings, and were about the size of small bees. They continued to creep along the ground, or hopped when their progress was interrupted.

July 27th.—They were increasing in size, and had overspread that part of the country in every direction. From the want of rain, and the overwhelming inroad of these insects, the farmers were nearly ruined. Nothing impeded their progress, they climbed up the highest trees and scrambled over walls, and notwithstanding the exertions of several people with brooms, the verandah and outer walls of the hospital were completely covered with them. They no longer continued to move in one particular direction, but paraded backwards and forwards, wherever they could find food.

On the 28th July, the rains set in with considerable violence; the locusts took shelter in trees and bushes, devouring every leaf within their reach; none seemed to suffer from the rain.

On the 29th it did not rain, and the young swarms again were on the move, continuing their depredations; they were fast increasing in size, and equally lively as before the rain.

It again rained on the 30th, and again the locusts took shelte on the trees and fences; several large flights of locusts passed over the cantonments, and I observed that the wings of the young ones began to appear. The head still retained the dark red colour, but the black lines on the body had become much fainter.

Again on the 31st, large flights continued to pass, driven by the wind to the southward; of course very few alighted. They caused little mischief within our view. The wings of the young tribe (the whole four being now formed) were about one-eight of an inch in length. After this time I made no particular observations on their progress, being otherwise engaged, but they disappeared in a few days."

A CORRESPONDENT in Dehra Dhoon writes:—"The seemul trees covered with large pods of silk-like cotton are now bursting with the warmth. Surely something might be done with this beautiful cotton, which is as soft as silk. No one has ever tried to manufacture any thing from this abundant and beautiful substance. Silky textures might surely be made from it, but it goes to waste. The flowers are large and beautiful of crimson hue, the natives eat them, the birds attack the buds, and yet there is an abundance of fine pods, large and full of cotton, and the tree itself is a very pretty feature in the Dhoon. This might become an article of commerce as well as the cocoons I lately alluded to—and if coal can only be found in the Dhoon, as has been asserted (and indeed I have seen samples), then we might expect to see factories spring up in this beautiful valley beside tea factories. The Dhoon has been ours for 63 years, and we have not yet done justice to it capabilities. "The strata of coal are said to run from west to east We want some explorers here."

DR. LACE has communicated to the Society of Acclimatisation an account of a plant which is used in Guiana as a tonic and anti-chlorotic, and of two out of the many serious cases that were cured by it:—A little girl of eight years of age was cholorotic to such a degree that the whole body was œdematous; her skin was transparent; she was given up by the doctors. A few days dieting on this valuable plant was sufficient to restore her health, strength and spirits. A middle aged man had become so enfeebled by hemorrhage that it was thought impossible he could live. He had scarcely strength to stand. A short time after using this plant, he recovered his strength to such a degree, that he can walk many miles without fatigue. This plant, endowed with such energetic tonic properties, and which ought to be placed at the head of the list of powerful bitters is the *Emilia rigidula* of Dr Candalle. It is cultivated in gardens like the common lettuce, which it greatly resembles, only it is smaller. It may be eaten as a salad, with a little salt, vinegar, and oil, fasting, for an hour or two before a meal. To sustain its action, a drink made by infusing the flonery tops, like tea is made, may be taken at the same time It is to be hoped that so remarkable and valuable a plant will be introduced into our gardens.

WE learn that the stand of Messrs, Sutton & Sons, the Queen's seedsmen, and seedsmen by special warrant to H. R. H. the Prince of Wales, will be one of the most exhaustive displays of Horticultural and Agricultural produce ever brought together. Taking advantage of the occasion of what will be the most wonderfu "World's fair" ever held, and of their high position as seedsmen to His Royal Highness the President of the Royal Commission Messrs. Sutton have been actively engaged for nearly 12 months in preparing their elaborate stand of 95 feet in length. We understand that there are more than two thousand models from nature of the principal kinds of Agricultural and Horticultura plants and roots in addition to nearly 500 specimens of permanent pasture grasses, as well as 800 samples of seeds. The display occupies a large portion of one of the extensive buildings erected at the special desire of H. R. H. the President, for illustrations of English agriculture, and it is already in such a forward condition that it was expected to be quite ready for H. R. Highness's private view on the 26th of April. Not only inside are Messrs. Sutton making such an extensive display, but in the Exhibition grounds nearly three acres have been sown with Messrs. Sutton's grass seeds, which are now rapidly forming a beautiful sward. In addition to grass seeds Messrs. Sutton have supplied an endless quantity and variety of flower seeds, which will be transplanted during the summer in various parts of the exhibition grounds, and a most brilliant effect is anticipated.

COMMUNICATED AND SELECTED.

REPORTS ON THE WORKING OF GOVERNMENT FARMS FOR APRIL 1878.

KHANDEISH EXPERIMENTAL FARM.

Superintendent, Mr. A. Stormont.

Jowari threshing.

Jowari winnowing.

THE threshing out of the jowari (millet) crop was finished during the month. The work was done partly by an American threshing machine and partly by bullocks in the native fashion. The former method is by far the more expeditious, but when the cheapness of manual labour on the one hand, and the enormous expense of all kinds of iron work, repairs on the other, are taken into account, economy is found to be decidedly in favour of the primitive method. In the case of winnowing machines the result is far otherwise. An enormous amount of labour is involved in hand-dressing a sample of corn up to the standard obtained by a single passing of it through the fanners.

Outturn and value of the jowari crop.

The outturn of jowari is about ¼ below a good average crop, but on account of the abnormal condition of rates and prices the *money*-value is considerably higher. This is exhibited in the following table, where it will be seen that the value of the *light* crop at the *high* price is considerably more than that of the average crop at the average price. It is the irrigated portion of the crop (two-thirds of the whole) however which brings up the figures. The non-irrigated fields produced very little :—

	AREA.		Total outturn in measured seers of 3⅛lbs.	Total outturn per acre in seers.	Total value of crop.	Value per acre.	BALANCE IN FAVOUR OF BAD YEAR.	
	A.	G.					Per acre.	Total.
Jowari crop of 1877-78.					Rs. A. P.	Rs. A. P	Rs.A.P	Rs.A.P.
Price of grain being Rs. 23 per *mdp* of 192 seers ..	69	15	12,648¾	180	1,503 0 0	21 0 0	6 0 0	468 3 6
Average good crop with grain at the usual price of Rs. 12 per *mdp* ..	69	15	15,870	230	1,035 0 0	15 0 0		

Surgurcane.

4. Sugarcane crushing has been completed and jagree, &c., disposed of. The total receipts from *ten* acres is Rs. 950 against an estimate of Rs. 1,200 ; the deficit was, as stated in last month's report, owing to insufficiency of water from the failure of the Jamda canal towards the end of the season. It was found impracticable to prepare *jagree* from the later portion of the canes ; the juice was therefore merely boiled into treacle and sold at a much lower rate.

Manuring.

5. The carting of manure for next year's cotton and tilly crops has been completed, and the hoeing (with the *bakkar*) of the surface of last year's cotton land in preparation for sowing early jowari is still in progress.

Plantains.

6. A small plantation was made in the early part of the month, but as water from all sources subsequently failed the crop will be lost. A considerable plantation of the *sonkhela* (golden plantain) last year introduced from the Poona Deccan is also in imminent danger of drying up.

Distribution of seed.

7. A large quantity of fruit-tree and other seeds has been distributed.

Scarcity of cotton seed.

8. There is an enormous demand this year for acclimatized American cotton seed. The quantity applied for up to date for *bonâ fide* sowing purposes is over ten tons. On account of the failure of the cotton crop here, there will be unfortunately very little of the farm seed available for distribution. I have however promised to help the people in getting a supply from Dharwar.

Sericulture.

9. The mulberry plants having shed their leaves from drought, silk-worm rearing has been suspended for the present.

Stud cattle.

10. Three additional stud bulls, all of the Mysore breed, have been located during the month in the trust of cow-keeping patels in different parts of the district.

Weather.

11. The heat has been intense, reaching a maximum in the shade of 98° on the 2nd instant. This was succeeded on the following day by several showers amounting to over half an inch.

NAGPORE MODEL FARM.

Officer in charge, Captain J. W. Macdougall, Deputy Commissioner.

Weather.—The month has been as a whole cool for the season of the year, with occasional falls of rain. A violent storm accompanied with hail on the 6th unroofed a portion of the farm sheds.

Work.—The work done during the month consisted of cotton ginning, sugarcane planting and pressing. Three acres of young cane were planted out and are doing well. Ginger and arrowroot have yielded a fine crop, but the cultivation of arrowroot will be discontinued, there being no demand for the prepared article. Lucerne is looking well and yielding a rich fodder, guinea grass, transplanted in February, is looking up. This crop is a short one during our dry hot season taking a considerable time to recover after cutting, a defect owing chiefly to want of sufficient irrigation and manure. The hoeing of fields (with the *bakkar*) is in progress for the coming season. The soil does not yield well to the action of the *bakkar* shares. A large stone *chaki* or grinding mill is in course of erection for grinding bones.

The past harvest has proved itself a very short one as respects all *rabi* crops. Chenna so short as to command a higher price in the market than wheat, and the vetch tribe generally is in the same condition. Wheat is so much spoilt as to necessitate our going to other quarters for next year's seed grain. The beneficial action of lime as a manure has attracted the native agriculturist's attention, the *goor* expressed from a crop of sugarcane thus manured, being much praised by them.

HOW TO GROW POTATOES OF THE MOST PROFITABLE SIZE.

BY C. D. H.

EVERY now and then some agricultural journal reports, that such and such a farmer has planted his potatoes whole, and has found his crop much heavier in consequence. But still we see that his neighbours, and by and bye the man himself, cut their seed and plant in the old way. On inquiry it is often found that with the cut seed there were fewer small potatoes, and more of the crop was fit for table use, than when whole seed was planted. Now, this is a most important fact if true, and, as the writer has personally tried upwards of a hundred expriments on this very subject, some of the lessons he learned cannot but be of service to many.

The mere experiment of cut *versus* whole sets is an old one, but the error usually committed is that of planting the whole potatoes at the same distance apart as the cut ones, for of necessity the uncut seed must use per acre perhaps twice or three times the weight of the cut seed. Now, that is the secret of the heavier crop. Planted in equal quantities per acre, cut seed gives neither more nor less crop than whole potatoes. Out of 70 experiments tried by the writer on Mr. Lawson's experimental farm in England, and of over a hundred other related in the English agricultural journals—a few exceptions of course occur, but—taking general averages, the weight of the crop was found to depend very much on the weight of seed per acre—provided always the sets were not planted further apart than 12 inches.

An example will show this better than any amount of explanation. Two plots were planted with 1-ounce cut seed, (2-ounce potatoes cut in halves), and two other plots with 2-ounce potatoes, uncut. In both experiments the sets were planted 6 inches apart, but it is evident that the uncut seed would require twice the quantity of potatoes per acre, each set being just twice as heavy. The gross yield from the cut seed averaged 10 tons 16 cwts. per acre, and from the uncut seed 12 tons 4½ cwts ; the heavier crop, of course, being given by the heaviest seeding. But while the extra seeding weighed only, 20 cwts. the extra crop weighed 32 cwts.

Cumberland, in the West of England, is, of course, different from Victoria and, both on account of climate, and more especially soil, the following experiments will need modification. In dry districts and poor soils the seeding may have to be doubled ; but in such famous districts as Warrnambool, and in deep loamy soils, it may be wiser to reduce the seeding or increase the distance one-half or one-third. The variety of potato was Regents—a very popular one at home in 1870.

In the following experiments, sets weighing 1, 1½, 2, 3, 4, 6, and 8 ounces were planted at distances apart of 4½ 6, 9, 10½, 12, 18, and 24, inches, and not only was the gross weight of the crops tested, but each lot was sorted into sizes, and these weighed also. The potatoes retained by a 1½ inch riddle fetched the best price (£3 a ton) as table potatoes. The smallest size—that passing through a 1½-inch riddle—were called pig potatoes, and valued at £1 6s. 8d. a ton, or 2d. a stone ; whilst the medium size, between the two, was sold for seed at 30s. a ton.

The size of the tubers is a most important point. For instance, in one of the experiments 6-ounce potatoes were planted 6 inches apart, a seeding of about 5 tons per acre. The return was for the season correspondingly heavy, weighing about 10 tons per acre, but such a quantity of small, nut-like potatoes was never seen. On riddling them only 1½ cwts. were obtained fit for table use, and 70 per cent. of them were fit for nothing but pig food. The acreage value proved only £18 5s. 4d., whilst the seed cost £14, large seed being dear. As a contrast to this, plot 11, with 2-ounce sets planted 12 inches apart, yielded only 6 tons 8 cwts. per acre, or 3½ tons less than the 6 ounce sets. But when sorted almost 8 tons were found fit for table use, and the acreage value was £14 18s. 8d., or 28s., more than the other, whilst the seed cost only 35s. Thus the heavier crop was a dead loss, failing to pay for its seed by £3 per acre; the lighter crop, on the contrary, proved more valuable, and paid for its seed nearly £13 per acre.

The mere gross weight, then, of a potato crop is a poor test of its value. Potatoes are very exhausting to the soil, and hence a light crop, if all the roots are large enough for table use, must pay better than a heavier crop of small potatoes.

The drills in these experiments were rather broad—only 3 inches short of a yard, and the manure was a chemical one, supplying potash as well as phosphates and ammonia.

To test the question of cutting the seed, a series of experiments was then arranged. All the sets were planted at the uniform rate of 20 cwts. per acre. Four ounce sets were planted whole at 2 feet apart, and others cut into two, at 1 foot apart, and others cut into three at 8 inches apart. Three-ounce sets were planted, the whole ones at 18 inches, the cut at 9 inches; and finally 2-ounce sets were planted, the whole ones a foot apart, the cut ones 6 inches apart. Fourteen plots in all were so planted, and the returns were surprisingly similar. To give the details of each is unnecessary at this stage, as the average results will tale the tell better. The gross weight per acre was

	Tons.	cwts.	lbs.
From whole sets	11	12	39
From cut sets	11	15	37

Figures surprisingly near for the average of 14 trials, and showing that cutting the seed has but little practical effect on the gross weight of the crop. But how about the table potatoes? At first I thought that cutting the seed promised more table potatoes, but exact tests showed that with equal seeding there was no general practical difference. Thus in the 14 trials under consideration the weight of table potatoes was as follows:—

	Tons	cwts.	lbs.
From whole seed	5	14	82
From cut seed	5	8	102

The uncut seed, as a whole, giving if anything the larger yield. The crucial test, however, is furnished by the net returns per acre, which show the value of the crop, both of the large and small sizes, less the cost of the seed. This was from

Whole seed	£24	10	3
Cut seed	24	1	2

Showing so slight a difference as not to warrant us in saying the one was better than the other. Cut seed, we shall see, has, however, several advantages, one of which may be mentioned in this connexion, namely, that if one set should die, or from any cause should fail to grow, the interval—say twice 9 or 18 inches—between it and the neighbouring sets is not so wide but that they can fill up the space. Whereas, should a four-ounce set die, the interval of four feet thus left between the next two sets is far too wide to be utilised by them. Other reasons for cutting the seed will appear by and bye.

The next point of importance is what is the best size for seed potatoes? Farmers, as a rule, reserve the smaller, but not quite the smallest, for seed. Is this custom really economical? All other plants give the best return from the best seed. Are potatoes an exception? Experiments on this point were tried in 1869 and 1870, but the two years differing greatly in yield, each must be taken alone. In 1870, fifty experiments were tried. To give the details of all would be needlessly confusing, but the averages given are in most cases those of three or four beds. For where so many beds are required it is necessary to repeat the same experiment in different parts of the field to allow for soil variation and accidents. Comparing only those plots getting equal quantities of seed, the result was as follows for seedings at the rate of 20 and 40 cwts. per acre.

GROSS WEIGHT PER ACRE, FROM

	Tons.	cwts.	lbs.
1½ ounce sets gave	10	15	72
2 " " "	11	8	62
3 " " "	10	9	22
4 " " "	11	4	54
6 " " "	10	14	107

One ounce uncut seed potatoes were not tried, such small sets proving too weak for good returns. Eight ounce sets were tried only in 1869, but for equal quantities of seed were surpassed by 4 and 6 ounce sets; they grew however, as many large potatoes as the 4 or 6 ounce, and the net returns were equally good. But for all practical purposes 8 ounce sets are almost impossible to get; and as 4 ounce sets proved equally good in every respect, it is needless to use the larger sets. The foregoing figures show that small sets are not economical. The 1½ ounce potatoes gave a yield three-quarters of a ton short of an equal weight of 2 ounce sets, and the 4 ounce sets proved also more productive. The inferiority of the small sets is still more clearly seen in the yield of table potatoes, which was as follows:—

TABLE POTATOES PER ACRE, FROM

	Tons.	cwts.	lbs.
1½ ounce sets gave	2	17	66
2 " "	3	13	106
3 " "	3	5	90
4 " "	5	4	109
6 " "	3	7	96

There can be no mistake here what size of seed has most vigour, and grows the most profitable potatoes. The 4 ounce sets surpass the others unmistakably, and next to them comes the 2 ounce sets. The same position holds good in the net returns, as below:—

NET RETURNS PER ACRE, FROM

1½ ounce sets gave	£18	4	5
2 " "	20	13	6
3 " "	16	15	7
4 " "	21	0	6
6 " "	15	19	11

Clearly it pays best to plant the best seed. Pedigree counts for much in man, cattle, or plants. A good stock pre-supposes a good sire or grandsire, and proper-sized potatoes can only be grown from proper-sized seed. The 4 ounce set is possibly the normal or slightly over-average sized potato, and like the average-sized man—as insurance companies know—will live longer and do more work than a six-footer or a smaller man. Neither the 3 ounce nor the 6 ounce approaches the 4 ounce in value; and as each result (except for the 6 ounce) is the average of four plots of each size, the position of the 4 ounce cannot be accidental. In 1869 as well as in 1870, the 4 ounce set proved the best also, showing that in that size of potato lies the best health and energy of the tuber.

At what distance apart in the drill should potato sets be planted is our next question, and we have 87 plots planted at various distances available for comparison. For the distances up to 18 inches many of the averages are from eight plots, but for 24 inches the averages will be too favourable, as only large potatoes were planted at that distance.

GROSS WEIGHT PER ACRE, FROM.

Distances	of	4½in.,	11	tons	1cwts.		15lbs.	
"	"	6 "	11	"	10	"	85	"
"	"	9 "	11	"	6	"	93	"
"	"	10½ "	11	"	17	"	110	"
"	"	12 "	9	"	17	"	6	"
"	"	18 "	10	"	12	"	14	"
"	"	24 "	10	"	8	"	61	"

Evidently 10½ inches was the best interval between the sets, surpassing every other distance very considerably; 4½ inches is decidedly too little, but still the shorter distances always surpass the wider ones which go beyond 10½ inches. Sets separated further apart than 10½ inches could not evidently, in the soil experimented upon, utilise the increased space. In the *Royal Agricultural Society's Journal* for 1867, Mr. George S. Maw, reports on 120 experiments somewhat similar to these, and he also found a falling off in the crop with distances exceeding 12 inches, and recommended 9 in preference to 12 His experiments included a dozen varities of potato. Late Red he found gave the heaviest yield, and next to them flukes. He tried four varieties of kidney, three of flukes, and some other fancy varieties with very promising names, but, as usual, with equally small performances. Prolific names do not always mean prolific crops. His experiments, however, only tested the gross weight of the crop, as he attempted no kind of sorting, and the quantity of marketable potatoes is, we have seen, a matter almost equally important with the mere weight per acre. Of table potatoes the foregoing plots gave the following average returns:—

TABLE POTATOES PER ACRE, FROM

Distances	of	4½in.	gave	2	tons	12cwts.		72lbs.	
"	"	6 "	"	3	"	9	"	42	"
"	"	9 "	"	3	"	18	"	12	"
"	"	10½ "	"	4	"	5	"	4	"
"	"	12 "	"	3	"	15	"	58	"
"	"	18 "	"	3	"	10	"	20	"
"	"	24 "	"	5	"	0	"	89	"

Again, 10½in. proves the best distance, because, as before mentione the 24in. figures are the average of the two plots only, and both of thei with large seed, and large seed, we saw, gave the most table potatoe Leaving the 24in., for the moment, out of sight, it is striking to see ho 10½in. stands in the middle as the best distance, and how those neare it, such as 9in. and 12in., come next in goodness, while the distances mo unlike it, especially those narrowest, stand worst.

The evidence is thus very strong in favour of 10½ in., or, at least, som thing less than 12., and yet more than 9 in. This is further confirm when we compare the money returns per acre, less the cost of the seed.

NET RETURNS PER ACRE, FROM

Distances of	4½in. gave	...	...	£13	11	8
" "	6 " "	...	...	20	13	8
" "	9 " "	...	...	19	12	6
" "	10½ " "	...	...	22	0	5
" "	12 " "	...	...	18	3	0
" "	18 " "	...	...	18	6	1
" "	24 " "	...	...	20	15	8

There can be no doubt here but that 10½in. was the best distance. ' surpasses the 24in. by 25s. an acre in the final returns, and exceeds all others by an average of £3 per acre. With large seed we saw the intervals give more table potatoes, but the gross weight was 1½ tons sh of the 10½in. intervals, and hence did not return so much money per ac Yet with large seed it is evident that wide intervals are necessary, and wh the small potatoes cannot be economically used for pig-feeding, &c., is worth remembering that large seed give a fair crop and the few small potatoes, if planted 2ft. apart. For general purposes, however, 10½ proved the best distance for seed, cut or whole.

The next question is what quantity of seed per acre gives the most pro able return? It is evident, however, that with drills a yard wide, m less seed will be required, than with drills only 30in. wide. An a measures 4,810 square yards, and therefore drills just one yard wide wo require only 4,840 sets if planted 3ft. apart, and of course a half more 7,260, if planted 2ft. apart, as advised for 4oz. sets; but as such sets we ¼lb. each, this would be at the rate of 1,815lbs., 16¼ cwts. per acre. 30in. drills, though planted in an exactly similar way, would t one-fifth more seed, or altogether 19½cwts. As, however, s experiments presently to be given, recommend the wider dr the seeding is reckoned below for yard wide drills. I have kn many farmers deceive themselves as to the quantity of seed they used. T at home one very successful farmer I knew told me he was planting at rate of 10 cwts. per acre. I assured him he was nearer double that, wh saw his seed, and the distance apart at which he planted them. The s was cut, and varied much in size; but on weighing a hundred of the n t averaged a little over 1½oz. each. His distance was 10½in., his drills 2 wide, and when all was reckoned up he found he was using 18½cwts. per a Two ounces is a common size for seed, and at 14in. apart such would 18 cwts. per acre. With this warning we may now proceed to examine returns from different quantities of seed.

GROSS WEIGHT PER ACRE.

8 cwts.	of	seed	gave	8	tons	19cwts.		17lbs.	
10 "	"	"	"	8	"	12	"	8	"
16 "	"	"	"	10	"	13	"	86	"
20 "	"	"	"	11	"	3	"	84	"
26 "	"	"	"	10	"	10	"	42	"
32 "	"	"	"	11	"	7	"	3	"
48 "	"	"	"	9	"	7	"	21	"

I give some of the above figures with hesitation Experimenters soon so many things to interfere with fair comparisons, that nothing bu agreement of many separate trials gives them confidence in their re The figures for 8cwts, 10cwts., 26cwts. and 48cwts. are the average of two plots each. That for 32cwts. is the average of 11 plots, and it is the Comparing it with the other two quantities derived from large avera namely 16cwts. and 20cwts.—it is evident that the yield is in proporti the quantity of seed, but that the heavier seedings increase, less tha more moderate ones. Mr. May's experiments before referred to, even better returns for large quantities of seed, about 3 tons giving him heaviest returns, even when the weight of the seed was deducted. In by close planting of large seed in narrow drills enormous crops can be g Mr. Maw obtained as much as 30 tons per acre, but, then, what were worth? Such heavy crops give small worthless potatoes, quite unmar able for table use. The foregoing figures, if the weight of the seed deducted, recommend that the quantity planted should not exceed 20 per acre, and this we shall presently see is too much. The weight of marketable potatoes per acre was as follows:—

TABLE POTATOES PER ACRE.

8cwts. of seed gave	4 tons	6cwts.	0lbs.
10 „ „ „ „	4 „	17 „	0 „
16 „ „ „ „	4 „	0 „	24 „
20 „ „ „ „	3 „	6 „	68 „
26 „ „ „ „	3 „	6 „	88 „
32 „ „ „ „	3 „	0 „	110 „
48 „ „ „ „	1 „	15 „	70 „

The above figures are very striking. It is remarkable how steadily the quantity of table potatoes was actually reduced as the quantity of seed was increased beyond 10cwts. From nearly 5 tons, where 10 cwts. of seed was planted, we got as low as ¾ tons where 48cwts. was planted. It may also be remembered that in my first article an experiment was quoted from the 1869 series with 5 tons of seed, and the consequence was a return of only 10½cwts. of table potatoes the remaining 9½ tons being so small as to be useless for market. Truly, it is easy to pay too much for a large crop. Farmers, in trying experiments on potatoes, must always weigh the marketable roots separately, or they will be led astray.

Coming now to the crucial test—the cash returns per acre we find the results much the same.

NET RETURNS PER ACRE.

8cwts. of seed gave	£19	8	5
10 „ „ „ „	22	18	6
16 „ „ „ „	21	1	0
20 „ „ „ „	19	19	10
26 „ „ „ „	18	5	9
32 „ „ „ „	16	16	0
48 „ „ „ „	7	11	11

As before, 10cwts. of seed stand the most profitable, and 16cwts. next. But it will be wise to repeat the caution that the facts for the 16cwts. are much more certain than for the 10cwts.; and seeing, too, that 8cwts. proved inferior to 10cwts., 16cwts., and 20cwts. of seed, these experiments suggest a seeding somewhere between 10cwts. and 16cwts. Richer soils will, of course, do with less, and poorer soils will need more; but accurate experiments always offer a firm basis for a man of good judgment, and are especially useful in warning him against rash and careless advisers, who first deceive themselves and then seek to persuade their calmer brethren that by some means a man can manage to reap what he does not sow, and to grow mountains out of molehills.

It has been seen that the most profitable returns were given by large seed, and also that large seed must be planted at very wide distances to get the best returns. But the experiments on different distances, showed that the gross weight of the crop was always lessened, when the distance between the sets was increased beyond 10½in. How, then, can we reconcile the three conditions of large seed, moderate distances, and yet not an excess of seed to the acre? Four-ounce sets planted at 10½in. apart would take nearly two tons of seed per acre, and we have seen that the quantity was just three times too much. Herein lies the secret of why farmers as a rule cut their seed. Market-gardeners do not so invariably cut their seed as farmers—some varieties of potatoes will not stand cutting. But the custom of cutting the seed has its ground in long experience, and is practically sound. If we cut our large sets and plant them closer we get a heavier crop. At the same time, however, we find the closer interval causes more of the potatoes to be small, and the wise farmer will seek to balance those things.

Some lay much stress on the mode of cutting the seed, and are careful to cut each potato from the crown downwards, so as to leave a part of the crown in every set. Others try to leave two eyes in every set, neither more nor less, and if a third eye is visible, will even take the trouble to cut it out. These opinions are so general that, possibly, there is something in them. Personally I have not tested the matter, but this I can say, that I have seen good potatoes grown from a set that had no eyes at all, and that, in all my experiments, nothing ever occurred to make me think the method of cutting the seed was of great importance.

In the first of these articles it was seen the more cutting of the seed could not be said to be any decided advantage, and if every farmer and labourer were a mathematician and would take the trouble to weigh the seed, and proportion the distances between the sets accordingly, I would not advise cutting the seed. But in every day work the farmer has not time, even had he the knowledge and will, to calculate these proportions. Labourers, too, have their notions as to the right distance, and would be certain to plant uncut sets much too near each other. And that, we have seen, is an exceedingly wasteful abuse of large seed. Thus of table potatoes, 4oz. sets gave, per acre, at different distances.

At 9in. apart	2 tons	6cwts.	88
„ 12 „ „	3 „	11 „	18
„ 24 „ „	6 „	18 „	84

Now, only a very intelligent labourer, unless his master was standing over him, could be persuaded to plant potatoes at 24in. apart, and yet with 4oz. sets, anything less would only give an inferior yield of useful-sized potatoes, with a larger quantity of small worthless ones. But by cutting large seed into two or three parts, any labourer may be trusted to plant them at something less than 12in. apart. Indeed, if potatoes about 4oz. in weight are cut into three, the proper distance at which to plant them is just about the length of an ordinary man's foot. In the following experiments the cut sets were planted 8in. apart, but that, we have seen, is too near; still there is practically no difference between them and the uncut seed at 24in. apart The net returns from each were—

4oz. seed, planted whole	£25	18	1
4oz. seed, cut into three, and planted at one-third the distance	25	11	6

The returns are very close, so close that probably had the cut seed been planted at 10½ in. apart, instead of 8in., it would have proved superior. From what has been seen before we would, of course, expect to find the close distances and cut seed give the heavier gross yield, but less weight of table potatoes; the figures bear out this expectation fully—

	Gross Yield.			Table Potatoes.		
	Tons	cwts.	lbs.	Tons	cwts.	lbs.
Whole seed	11	11	58	6	18	84
Cut seed	12	6	66	5	18	74

The whole seed, and wide distances, grew more marketable potatoes, the cut seed grew a heavier gross weight; and, as we have seen, the net returns from each were almost identical. This would make the question between cutting or not, one of convenience entirely, and certainly, as before hinted, cutting the seed is practically the better plan. With 4oz. seed cutting the sets proved decidedly profitable.

How wide should the drills be to get the best returns? If mere weight is wanted, then, as before hinted, the narrower the drills and the closer the seed, the heavier the crop, provided always there is no drought. This is an important proviso. At home, where drought is almost unknown, small drills might prove suitable, that here would be ruinous in a dry season. Good wide drills are of great value both in keeping more of the soil moisture about the seed, and in presenting less surface for evaporation. True, each drill is larger, but then there are only 70 drills to the acre, if each is a yard wide, instead of 87, if each was 29in. Certainly the wide drills offer less acreage of surface to the drying winds, and besides enclose a greater body of earth, and that must resist drought longer beyond all comparison.

Another advantage of wide drills here, which was not felt so much at home, where labour is cheaper, is the saving of both horse and manual labour, which 70 wide drills must offer as against 87 narrower ones to each acre.

In 1869 and 1871, I tried experiments on wide and narrow drills, and found the narrowest drills give the heaviest crop, but so many of the potatoes were small, that the largest drills paid best. Eighteen-inch drills were tried in 1869 only. For gross weight they surpassed the yard drills by 27cwts. per acre; but in spite of this advantage, the marketable potatoes weighed less by 48cwts. The narrow drills used also, of course, just twice as much seed and when all was reckoned up, they proved 11s. per acre inferior to the wide drills. As drills of 24in. 30in. and 36in. were tried both seasons, the averages of the two are given below:—

GROSS WEIGHT PER ACRE.

24 in. drills gave	7 tons	2cwts.	85lb.
30 „ „ „	6 „	10 „	5 „
36 „ „ „	6 „	98 „	72 „

The narrow drills, as was expected, gave the heaviest weight per acre. But how much of these were large enough for table use? The weights below show that for the marketable potatoes the reverse holds good.

TABLE POTATOES PER ACRE.

24in. drills gave	3 tons	1cwt.	33lb.
30 „ „ „	3 „	6 „	50 „
36 „ „ „	3 „	16 „	50 „

The narrow drills are here the worst, and as at the same time more seed is required, the drills being so much more numerous, the net returns are also least from the narrow drills.

NET RETURNS PER ACRE.

24in. drills gave	£12	19	8
30 „ „ „	12	17	5
36 „ „ „	14	4	8

The yard wide drills thus proved in the end superior by 25s. per acre. exclusive of the saving in labour, which at home was nearly another 25s. The cultivation for a potato crop on Mr. William Lawson's farm in Cumberland, England, cost £3 10s. 11d. per acre, and the harvesting 3-s. 6d. Of this not quite one-third less would be required on 36in. drills as against 24in. ones, yet one-fifth, or 23s. per acre is not too much to reckon as saved, and with dear colonial labour it would be much more. Everything considered, the wide drills should be best in this colony.

As regards manure, the potato soils of this colony cannot compare with the poorer gravels of Cumberland; but for those who have to grow potatoes on poor soil, I may mention that potash was found to increase very considerably both the gross weight and the proportion of marketable potatoes. Used as muriate of potash, 4cwts. per acre (with guano and dissolved bones) increased the weight of the crop about 28cwts. per acre, and the proportion of table potatoes 12 per cent., or the total value per acre by £5 5s.

As regards the best place for potatoes in a rotation of crops, we found on our gravelly loams that hay as the preceding crop always notably increased the proportion of table potatoes.

To sum up the lessons taught by the foregoing experiments, the following points stand most prominent:—

1. Use large seed (about 4oz). Harvest time is sure to prove it most economical.
2. If you wish to plant large seed whole, let the distance between each set be very wide; more than 24in. for 4oz. sets.
3. If the seed is to be cut, still use large seed, and cut it into three or two and plant them about 10 in. apart.
4. The best distance between the sets (for cut seed) was found to be about 10½in.; for whole seed much wider.
5. The quantity of seed per acre should be less than 16cwts.
6. The drills should be very wide, probably a yard rather than anything less.
7. The manure should contain potash, bones, and guano.
8. A hay crop form the best preparation for potatoes.

From the Australasian.

MANUFACTURE OF MANURE IN GREAT BRITAIN.

WHEN in 1889 the Royal Agricultural Society commenced its career of usefulness, and adopted for its motto the words "Science with Practice," a rapid improvement took place in every department. The implement-maker and the chemist vied with each other in their endeavour to bring science into practice; the one lightening and economising manual labour by the introduction of improved threshing, mowing and other machines and by devising means for breaking up and cultivating the heavier land by steam power; the other examining the composition of soils and plants, and assisting the farmer to return to the land in the shape of organic and mineral manures the elements extracted by previous crops. Soon great breadths of land not hitherto cultivated or cultivated with difficulty in consequence of the expense of carrying farmyard manure were thus brought into a high state of fertility; this was particularly the case in counties such as Devon and Cornwall, where hills abound and the rainfall is excessive. On the other hand it was soon found that artificial manures might be applied with advantage, particularly for the root crop, where the farmyard manure was exhausted, or it was desirable to leave it to be used with more advantage on the clover, wheat, beans, &c. The manures mostly used were bones (which, strangely enough, seem to have been altogether neglected as a manure till the close of the last century), fish, gypsum, salt, soot, rags and other refuse matters. One of the earliest of the portable manures was a mixture of night-soil with ashes or dust, and this "poudrette" was occasionally sold, but was much too bulky and expensive to be generally used. In 1842 the "urate" was introduced by the London Manure Company. This was a dry powdery article, intended to supply the same constituents as farmyard-dung, and it met with a considerable amount of success but by many it was then thought ridiculous to suppose that 7cwts. (the quantity used) was sufficient to manure an acre of land; and the writer of these lines was subjected to a good deal of friendly quizzing for venturing to propose it; but, later on, when 3cwts. of guano and 1½cwt. of nitrate of soda were proved to be sufficient for an acre, the bulk of the "urate" was reduced by one half, and it was sold in its present concentrated form. Soon several firms, both in London and in the large country towns (most of whom still exist and retain deservedly the confidence of the public), commenced the manufacture and sale of manures—an industry which has extended so rapidly that there are now few counties without their manure factories. It would be impossible to estimate correctly the quantity of artificial fertilisers manufactured in the United Kingdom; but it is well known that some of the leading London firms turn out from 10,000 to 80,000 tons annually, and many country firms make fully as much. In 1840 nitrate of soda was just coming into use for the land, though it had long been exported and used in the manufacture of sulphuric acid, etc. The importations were in

	Cwts.		Cwts.
1829	506	1859	519,722
1839	25,583	1869	906,694
1849	25,873	1876	3,835,600

The prices ranged from £26 per ton to £11 in 1876. The remarkable increase in the demand during the last six years may be attributed to a large extent to the fact of guano becoming of a doubtful quality, and to the farmer having adopted the use of the nitrate of soda with phosphate to supply its place.

GUANO—It was not till the year 1840 that Peruvian guano was imported into this country. At first a few casks came; these were speedily followed by a regular cargo, a portion of which was bought by the writer at £24 per ton; its value soon became known, further cargoes arrived in rapid succession, and the price was considerably reduced. The trade was eventually taken up by Messrs. Anthony Jibbs and Son, under whose careful management it increased in a most astonishing manner, and as they allowed no guano to be sent out that did not contain 16 per cent. of ammonia, and 25 per cent. of phosphates, both dealers and farmers were fully assured as to results, and, at the price then charged, from £10 to £11, no better or cheaper manure ever came into the market. The history and value of Peruvian guano are so well known that it would be needless to do more than give the importation for a series of years as under :—

	Tons.		Tons.
1841	2,881	1859	84,122
1842	20,398	1860	141,435
1843	5,002	1861	178,423
1844	104,251	1862	141,636
1845	283,300	1863	233,574
1846	89,203	1864	131,358
1847	82,392	1865	237,393
1848	71,414	1866	135 697
1849	83,438	1867	192,308
1850	116,925	1868	182,343
1851	243,014	1869	2 0,010
1852	129,889	1870	200 311
1853	123,166	1871	178,808
1854	235,111	1872	118,704
1855	305,061	1873	184 420
1856	191,501	1874	112,285
1857	288,362	1875	114,223
1858	353,541	1876	210,918

This table includes the imports of Ichaboe and a few other guanos, but chiefly relates to the Peruvian. It is much to be regretted that the quality of the Peruvian guano is now so uncertain, and so vastly inferior to the earlier importations, while the price is higher.

BONES.—For grass these have been very largely used, particularly in Lancashire and Cheshire, where the quantity employed varies from 40 to 60 bushels per acre. It is found almost impossible to keep up the quality of the grass without the liberal use of bones, somewhere about once in 20 years, and the result is fully commensurate with the outlay. The value of bones as a manure is so well known that little need be said about them, farther than that the home supply is far too small for our requirement, and consequently we have had to look to foreign sources for a very large portion of the bones used: the importations, which in 1844 were about 40,000 tons per annum, now considerably exceed 100,000 tons. Raw bones being slow in their action, it was found desirable to use them in a partially dissolved state. For the method of doing so, we are indebted to the researches of the late Professor Liebig, in whose *Organic Chemistry* (translated by Dr. Lyon Playfair in 1840), the following passage occurs:—"The form in which they (bones) are restored to the soil does not appear to be a matter of indifference, for the more finely the bones are reduced to powder, and the more intimately they are mixed with the soil, the more easily are they assimilated. The most easy and practical mode of effecting their division, is to pour over the bones in a state of pure powder their weight of sulphuric acid, diluted with three or four parts of water, and, after they have been digested for some time, to 100 parts of water and sprinkle this mixture over the fields before the plough. Experiments instituted on a soil formed from Grauwake for the purpose of ascertaining the action of manure thus prepared have distinctly shown that neither corn nor kitchen garden plants suffer in consequence, but, on the contrary, they thrive with much more vigour." This important suggestion was soon improved upon, and manufacturers turned out a prepared bone manure that could be sown broadcast or used with the drill. The first superphosphate was thus made. The quantity of bone material available was totally inadequate to the requirements of the land, and fresh sources of phosphate of lime were sought for and discovered. In 1844 or 1845 superphosphate was made from the fossil phosphate of lime, existing in the form of coprolites, which were raised in large quantities in Cambridgeshire and in Suffolk. Small supplies of mineral phosphate came from the plains of Estremadura, from Norway, and from Canada; vast quantities have been since imported from France, Germany, the Island of Sombrero, and latterly from Charlestown, in America, where "rock phosphate" is dredged from the Bull river. The imports of this very valuable substance have already reached 100,000 tons per annum.

Many phosphatic guanos, *e.g.*, Mexillones, Curacoa, Baker's Island, Bird Island, etc., have been from time to time introduced with varying success, for the more concentrated forms of superphosphate. The step from superphosphate to the special manures for various crops was an easy one. These are mostly mixtures of superphosphate with guano, nitrate of soda, sulphate of ammonia, potash, magnesia, etc. Being generally sent out in fine condition, they doubtless save the farmer much trouble, as in judicious mixtures the ammonia and phosphates are carefully adjusted for either grass cereals or roots. Several schemes have been proposed, and large sums of money have been expended by corporate bodies and others, for the purpose of preparing a portable manure from sewage, but hitherto it has been found that with the present system of drainage the fæcal matter is so largely diluted that its utilisation is a matter of extreme difficulty and it is very doubtful if even it will be found possible to obtain by precipitation a manure that will repay the cost of its production. Of course the use of artificial manure has not been confined to this country, and considerable quantities are yearly exported to the sugar plantations in the West Indies, Mauritius, and other sugar-producing districts. A large trade also is done with the coffee-planters of Ceylon, Madras, and the Cape, all of whom find they are obliged to restore to the soil, what a long course of cropping has taken away, so as to save their property from total destruction. Germany, Belgium, Russia, Sweden, and the north of Europe generally, are large consumers of manures. In thus reviewing the course of the manure trade since 1840, it will be seen that some millions of pounds are annually expended in imported manures and feeding stuff, independent of the large sums paid for superphosphate and other manufactured manures, most of which were unknown 40 years since. One is surprised to find that the farmer in his agreements and leases is still hampered in many cases with the old restrictive clauses as to his course of cropping and dealing with this produce. Surely it is time, when he is now called on to compete with the whole world in both corn and meat, that he should have the fullest scope for his intelligence and energy, as well as security for his capital.—*Edward Purser in the "Agricultural Gazette."*

MANURE AND THE PRODUCTION OF GREEN FODDER CROPS.

WE are frequently informed that, one reason for the wretched condition of agriculture in this country is the difficulty of obtaining manure. That manure cannot be obtained without trouble, and that its use puts the ryot to some extra labor, I readily admit. Farming would, of course, be a very much easier employment than it is, if all we had to do was, to plough and sow our land and to harvest and sell our crops; but in all long-settled countries, the agriculturist must do a good deal more than this. Unfortunately in this country, the more rapid is the increase of population, the more rapid is the decrease in the food-producing powers of our soils As a general rule, the productiveness of Indian soils is yearly decreasing, while in Europe under the influence of modern farming, the arable soils are yearly becoming more productive.

It is as much the duty of the ryot to exert himself, in procuring manure for his soil, as it is his duty to plough and sow his land. A ryot has no more right to expect a fair crop when he applies no manure to his dry land, than he would have had to expect a good crop from a sowing of seed scattered over unploughed land. The cost of the manure consists chiefly of expenditure on labor in collecting and bringing manure to the land, and this labor most cultivators can themselves perform.

I cannot understand why in this country the farmer should be allowed to do *exactly as he likes* with the land he rents from the State. The rent he pays is supposed to bear a fixed relation to the crop he produces, which of course, would be a very fair way of determining the rent, provided *the land was fairly tilled.* If the land is only half-tilled and starved as regards manure, the State's share of the produce will appear large, but let the land be properly tilled, and that share at once will bear but, a small proportion to the whole produce. Every tenant of State land, should be compelled to use manure; if he does not use it, he is robbing the State, for he carries off far more than he is entitled to. What house-owner would be content with an ordinary rent, from a tenant who besides availing himself of the usual privileges of tenancy, used up in his fires as fuel the window frames, doors, rafters, beams and other wood portions of the house, and yet, most of the ryots are dealing quite as badly, with the land rented by them, from the State; not only are they taking out of the soil, what would be removed under a fair system of husbandry, but they are destroying the natural productiveness of the soil.

It is true that the permanent exhaustion of arable soil under the influences of cropping, is practically an impossibility; but it certainly is the case that under injudicious cropping, the productiveness of a soil can speedily be brought down, so low as to render the soil not worth cultivation, a state to which a very large proportion of the arable soils of this Presidency have already sunk.

In most civilized countries, tenants are generally bound to have a considerable area of their arable land annually under what are called restorative crops, such as turnips, green fodder, &c., which must be converted into manure on the farms where produced, by the agency of the live stock. If it is necessary in countries where agriculture has reached a high state of perfection, to prescribe and enforce regulations for maintaining the fertility of the soil; surely in this country where agriculture is in the hands of poor, ignorant, superstitious people, it is the duty of the State, to which the land belongs, to prescribe and enforce regulations for the maintenance of its fertility.

We have in this country, many fodder crops eminently suited for general cultivation. why not then insist upon the ryot devoting certain proportion of his land annually to their culture? The proportion to the whole area need be but small, a sufficient area only to raise fodder for the working and milch cattle kept on the holding. In this way, a certain quantity of manure would be ensured, and the deteriorating influences, to which the land is now subjected, would in some measure, be checked. We are told that the ryot cannot afford to grew fodder; my answer is, that he cannot afford to lose his cattle by starvation, or lose their full services, from weakness; and *that the country cannot afford the cost of periodical famines.*

Of course the cropping of 10 or 15 per cent. of our arable land by fodder crops, would not altogether render the country independent in an unusually bad season, but I am convinced that, if a fair proportion of farmyard manure, made by properly fed cattle, was applied regularly to our arable soils, their powers of absorbing and retaining moisture would be greatly increased; and in this way, vast stores of moisture would be available, where now moisture is almost entirely absent.

The question is not whether it will pay the ryot to grow fodder any more than it is, whether it pays him to plough his land; the one duty is as necessary as the other. It is ridiculous to expect that the ryot will obtain a *direct* return for the fodder he may grow; the advantages derived from the consumption of a fodder crop on a farm, are never secured in a direct way, or at once, but they influence for good the whole working of a farm, for years, in many indirect ways, which effects in their aggregate value, exceed the value of any ordinary grain crop, produced under the conditions, common in this country. Under the village system, there would be no difficulty whatever, in determining whether the prescribed area of land was annually cropped with fodder crops.—*South of India Observer*.

MR. ROBERTSON'S REPORT ON THE AGRICULTURAL CONDITION OF THE COIMBATORE DISTRICT.

(Concluded from page 90).

THE FARMING OF THE UNIRRIGATED LAND.

Of the total area of occupied land in this district, upwards of two million acres is altogether unaided by irrigation water.

Dry crops are extremely precarious, and unfortunately it is upon the dry crops chiefly that the people must depend for food. On the better kinds of soils, fair results are obtained in average seasons: however, the area of such soils is but small compared with the area under occupation.

Since 1857 the area of the unirrigated land has been increased 45 per cent. In the official year 1857-58 the area under occupation was 1,591,976 acres, of which about 85,000 acres was irrigated land, leaving 1,506,976 acres of land unaided by irrigation. In the official year 1874-75 the total area under occupation was 2,298,726 acres; from this must be deducted the 85,000 acres of irrigated land, which leaves 2,213,726 acres of unirrigated land; or there were in 1874-75, 706,750 acres more of unirrigated land than in 1857-58.

I have before mentioned that after deducting the land permanently settled, the land under Government forests, hill tracts, and "waste," altogether 830,720 acres, there remains attached to Government villages under the ryotwary tenure 3,925,760 acres; of this 1,725,760 acres is unoccupied and pays no rent.

The large increase in the area of rent-paying land would, of course, be a satisfactory proof of progress were the land properly farmed; for there can be no doubt but that, under fair cultivation, the inferior soils, in the dry climate of Coimbatore, would yield much more produce, when tilled, than if left to produce natural herbage for pasturage.

In this district, as well as throughout Southern India, the unrented land has contributed, and does contribute, largely to the maintenance of the rent-paying land.

The revenue from land has been maintained by gradually bringing more and more of the unrented land under rent. Though the gross land-revenue of the district has been increasing, the average rent of the unirrigated land has, during the last 20 years, been gradually diminishing, as will be seen from the following statement:—

Official year.	Total area.	Deduct area irrigated.	Net unirrigated area.	Gross rent.	Deduct rent of irrigated land.	Rent of unirrigated land	Rent of unirrigated land per acre.		
	Acres.	Acres.	Acres.	Rs.	Rs.	Rs.	Rs.	A.	P.
1857-58 ..	1,591,976	85,000	1,506,976	25,31,004	5,50,000	19,81,004	1	5	0
1858-59 ..	1,626,115	85,000	1,541,115	25,88,441	5,50,000	20,38,441	1	5	2
1859-60 ..	1,7 8,426	85,000	1,628 426	26,72,323	5,50,000	21,22,323	1	4	11
1860-61 ..	1,727,980	85,000	1,642,980	26,92,342	5,50,00	21,42,342	1	4	10
1861-62 ..	1,776,971	85,000	1,691,971	27,38,874	5,50,000	21,88,874	1	4	8
1862-63 ..	1,829,542	85,000	1,744,542	[illegible]	5,50,000	21,42,762	1	4	7
1863-64 ..	1,910,024	85,000	1,825,024	26,[illegible],901	5,50,000	20,99,901	1	2	5
1864-65 ..	1,959,636	85,000	1,874,636	24,11,925	5,50,000	18,61,925	0	15	11
1865-66 ..	2,092,501	85,000	2,007,501	25,11,080	5,50,000	19,61,080	0	15	8
1866-67 ..	2,199,089	85,000	2,114,089	25,95,782	5,50,000	20,45,782	0	15	6
1867-68 ..	2,214,111	85,000	2,129,111	26,08,243	5,50,000	20,58,243	0	15	6
1868-69 ..	2,229,311	85,000	2,144,311	26,24,583	5,50,000	20,74,583	0	5	6
1869-70 ..	2,245,729	85,000	2,160,729	26,37,372	5,50,000	20,87,372	0	15	5
1870-71 ..	2,307,858	85,000	2,222,858	26,49,784	5,50,000	20,99,784	0	15	1
1871-72 ..	2,293,926	85,000	2,208,926	26,28,772	5,50,000	20,78,772	0	15	1
1872-73 ..	2,290,482	85,000	2,205,482	26,15,898	5,50,000	20,65,898	0	15	[illegible]
1873-74 ..	2,255,609	85,000	2,2 0,609	26,13,114	5,50,000	20,63,114	0	15	[illegible]
1874-75 ..	2,298,726	85,000	2,213,726	26,24,119	5,50,000	20,74,119	0	15	9

Not having figures showing the actual area under irrigation in each year during the period to which the statement refers, I have, in order to determine the area of unirrigated land, deducted in each year 85,000 acres, which is about the average area annually under irrigation, and, to determine the rent of the unirrigated land, I have throughout the statement deducted 5½ lakhs rupees in each year, the average income from the 85,000 acres of irrigated land. The area under irrigation is, I believe, almost exactly what it was 20 years ago, and the revenue from it has varied only slightly from the amount I have taken.

It will be seen that the average rent of the unirrigated land has fallen nearly 30 per cent in the last 18 years. The decrease is not, I think, due to any reduction in the rent, but to the large addition to the unirrigated area of inferior land paying a low rent, which necessarily reduces the average rent of the whole.

Of course the pressure of an increasing population will gradually force under culture more and more of the unrented land. We have seen that during only 18 years this increase has amounted to 700,000 acres, and we may expect that this gradual appropriation of the unrented land will go on until, probably, the whole is taken up for cultivation. Now, it is certainly far better that such land should be under tillage in districts circumstanced like this, *but the absorption under tillage of the whole of the ryotwary land will destroy the resources upon which the ryot has hitherto depended so greatly.*

Under the inferior agriculture practised the recent large increase in the area under tillage is, I think, a cause for serious alarm; for whenever an unpropitious season occurs, the cultivators of this newly-added area, which is nearly always composed of inferior soils, have nothing whatever to rely upon, and they, as well as those connected with them, have to seek other means of support which, in some seasons, they cannot obtain except by Government establishing relief works. The 700,000 acres of land added during the past 20 years to the area under cultivation will probably be occupied by not less than 60,000 families.

As long as only the moderately good soils are tilled, a rude system of husbandry may suffice to meet the wants of the cultivators, but *directly the inferior soils are taken up for culture it becomes necessary that an improved agricultural practice should be adopted*. The land that has recently been added to the cultivatable area is undoubtedly very inferior, and it is being cultivated in precisely the same rude way as the better soils of which previously the cultivated area chiefly consisted.

I saw large tracts of country which the ryots declared did not give more than about 5 bushels of grain per acre in the year; and, judging from what I saw of the growing crops, I should think that 5 bushels of grain would be as much as many of these soils would produce on an acre under imperfect tillage and without manure. Now, as 5 bushels of grain would not command more than 6 rupees in the local market, it will be seen that, after deducting rent, cost of seed, and cattle hire, or cattle keep, the ryot must get but a scanty subsistence in return for the labor he expends on such land, but this deplorable state of things is only what might be expected.

If it is necessary that these inferior previously rejected soils must be cultivated, it is clear then that a better system of husbandry must be adopted in order to get out of these soils a fair return; and I am convinced that, unless the agricultural practice in dealing with them is greatly improved, the State will experience greater and greater difficulties, on the recurrence of each unfavorable season, in supporting the people dependent on the produce of these soils.

Considerable portions of the district are covered by black soils, and some large areas by red soils, but the prevailing soil is grey in color, and is frequently intimately mixed with, and sometimes covered by, fragments of quartz rock, varying from a fine gravel to pieces of several pounds in weight. These grey soils have apparently been formed by the disintegration of the schistose rocks, gneiss, mica, and hornblende, which cover so considerable a portion of the district. From their origin, these soils are naturally poor, and when met with on high situations where they have been subjected to the washing influences of flowing water they have become very poor indeed from losing their clayey particles. A small area of country situated about 5 miles to the south of the town of Coimbatore is covered by a calcareous soil resting over a crystalline lime-stone, and in the neighbourhood of Coimbatore a conglomerate lime-stone is met with near the surface, but the soils resting on it are generally very thin, and afford but little support to crops during droughts—a serious drawback in this dry climate. The land bordering the lower slopes of the Neilgherry and Annamalay ranges is, in some cases, composed largely of disintegrated rock washed down from the higher slopes and is fertile. The soils that cover the lower ridges of hills and the isolated conical-shaped hills which are scattered over the district are generally very poor and thin, and in most instances almost altogether without vegetation. Considerable tracts of alluvial soil are found in the eastern and southern portions of the district bordering the large rivers, but these soils are generally under irrigation.

As a general rule, away from the slopes of the high mountains, the best soils are found at the lowest elevations; the soils appear to be worse and worse with each increase in elevation: indeed, the soils of the district might almost be valued according to their elevation; those in the lowest situations being valued highest, and the value decreasing with every 100 feet of elevation.

There is little worth special notice in the cultivation of this unirrigated land. The soil is everywhere only shallow-ploughed, and the only plough used is that common to Southern India, which stirs the soil, but does not turn it over. In one or two places I saw some very good cultivation, which had been produced by digging the ground over with crowbars; by means of these crowbars the soil had been stirred to a depth of fully 12 inches. This cultivation is performed only on black soils and during dry weather. Blocks of soil varying in weight from 10 to 20lbs. are raised and turned over; after a heavy shower of rain these fall to pieces, and a fine tilth is produced. As the clods break down, the roots of grasses, especially of the *hurrialleo*, which are difficult to remove when the soils are under ordinary tillage, are freely exposed and can readily be collected. The effects of this crowbar cultivation are supposed to last over 10 or 12 years. The expense of turning over an acre of ground in this way is great. I was informed that it took generally about 80 men one day to dig over an acre of ground, and that each of the men was paid 2 measures of grain for his work, which would represent a total cost equal to the value of 180 Madras measures of grain, about 10 rupees. The cultivation is, I think, very perfect and leaves but little to be desired. However, the area of land thus treated, in the year, is exceedingly small; throughout my whole tour I did not see 100 acres in all undergoing this cultivation, and my tour was in the season in which this species of cultivation is generally performed.

A considerable area (about 300,000 acres) of the occupied land is annually under fallow; but this so-called fallow is widely different from what is known as fallow in other countries, for the land is in most instances left untouched by the plough or other implement during the whole period it is supposed to be under fallow. Of course, as the land during the period produces no crop, it is resting for a time, but it gains but little from those influences from which land benefits so greatly when fallowed in a rational way.

Nothing whatever is known by the ryot regarding "rotation of crops" as this is understood in other countries. I say this advisedly, for I have taken some trouble in making inquiries. In some places I was informed that the ryots did follow a rotation in their cropping, but on making further inquiry I learned that the so-called rotation existed only in the imagination of my informants. In one place where I made inquiries I was informed that the so-called rotation was cholum followed by cumboo in each year repeated again and again, as long as the land would continue to bear a crop. The ryots, of course, understand that certain crops make a greater demand on a soil than others; for instance, it is common to crop land with sugarcane only every second year; while, land is cultivated with cotton in successive years, over a long period. Again, crops requiring much rain, are grown during the season of the year in which the rain-fall is usually the heaviest, and crops that can be sustained during growth by a moderate rain fall aided by dew, are grown during that part of the year when the dews are heaviest; and the same, in regard to temperature, some crops are grown only during the cold season when the temperature is low, and others only in the hot season. A rotation of crops is based on the following:—(1) each kind of crop takes up some particular kind of plant-food: if any crop is repeated too frequently on a soil, the special food on which it feeds will become exhausted in the soil; (2) certain insects always prey on a certain description of crop, and when this crop is grown too frequently on the same ground, these insects multiply to such an extent as to become seriously injurious to it; (3) certain crops grow in an upright position, and in the light open shade they afford great encouragement to the growth of weeds; while other crops form a dense shade over the ground and kill down the weeds; (4) some plants have short fleshy roots, and need for their healthy growth that the soil should be open and friable and in a good manurial condition; while other plants have long and numerous fibrous roots which enable them to live and thrive under conditions under which a short fleshy; rooted plant would almost starve. There are other reasons besides these given for the adoption of a rotation in cropping; but neither these, nor those above given, influence the ryot in the management of his land.

Nothing is more surprising at first to an agricultural observer in passing through this district than the remarkable absence of weeds on the unirrigated land. I travelled over considerable areas of land almost without a weed of any kind; however, I observed also *that the untilled waste was almost as free from weeds.* Though I travelled several hundred miles through the district, frequently at a pace not exceeding 2½ miles per hour, I rarely indeed saw any people engaged in weeding the land. Sometimes, in a journey of 15 or 16 miles, I did not pass a single field in which there were any weeding operations going forward. The absence of weeds on the cultivated land cannot be attributed to the industry of the people. Annual weeds appear to be almost unknown, excepting on the land irrigated by rivers or from wells; the long hot dry season effectually disposes of them. In several localities I saw land which had been lying untilled for some years, and which was nevertheless almost bare; and it must be remembered that although I ended my tour in the hot season it was begun in the cropping season.

The principal crops, on the unirrigated land, are cumboo (*Penicillaria spicata*), cholum (*Sorghum vulgare*), and raggy (*Eleusine coracana*); these together occupy about 70 per cent. of the area of the occupied land.

Cumboo is sown on the red and grey soils during the months of July and August, and is harvested in November and December; it occupies more of the unirrigated land than any other crop. It is grown most largely in Darapuram taluq, but all the taluqs produce a considerable area, excepting Oodumulpett and Collegal. The grain of cumboo constitutes the food of a considerable proportion of the people of the district, and its straw is consumed by the cattle. Judging from what I saw, the crop is harvested only when *dead ripe*, and its straw, accordingly, will possess a much lower feeding value than it might otherwise possess.

Cholum stands next to cumboo as regards the area of land occupied. The white variety is most generally grown. It is sown and harvested in the same months as cumboo. Black or red soils are preferred for cholum. In all the taluqs a large breadth of ground is cropped with cholum; the largest areas are in the Pollachy and Pulladum taluqs. The grain of cholum, equally with that of cumboo, is used as human food in the district; while the straw contributes mainly to the support of the draught cattle during nine months in the year.

Next as regards area comes raggy, which occupies annually about 150,000 acres of land. Raggy is also sown during the months of July and August, and harvested between the middle of November and the end of January. Raggy is a very important food-grain, and is in great demand, not only for local consumption, but for transport to the hills for the use of coffee plantation coolies. Raggy is cultivated throughout the district, the greatest breadth of land under it being in the Collegal and Coimbatore taluqs; its straw is also highly valued as cattle fodder.

In a small portion of the district where the rains of both monsoons fall, the sowing and harvest seasons are of course different to those I have mentioned. In localities so favourably circumstanced, two crops are frequently obtained in the year; a crop of cholum with the north-east rains, and a crop of cumboo with the south-west rains.

The three crops just noticed are grown to some extent on land irrigated from wells. Ryots distinguish two varieties of each. They speak of "garden cumboo" and "field cumboo," "garden cholum" and "field cholum," "garden raggy" and "field raggy." There is a very marked difference in the time in reaching maturity between plants of these so-called "garden" varieties, and those of the "field" varieties; the former reach maturity on the average in fully 20 per cent. less time than the latter. The garden varieties are generally matured about 15 weeks from the date of sowing; whereas the field varieties seldom reach maturity within from 18 to 20 weeks from the date of sowing. These differences in growth are due entirely to the differences in cultivation; the so-called "garden" varieties being always watered during growth have, from long habit, become rapid growers.

The cotton crop stands the next highest as regards area. The following statement shows the land under cotton during each of the past 22 years:—

Years.	Cotton. Acres.	Years.	Cotton. Acres.
1853-54	118,919	1864-65	157,8[illegible]
1854-55	115,527	1865-66	110,685
1855-56	135,920	1866-67	115,529
1856-57	91,053	1867-68	119,247
1857-58	113,663	1868-69	117,680
1858-59	131,711	1869-70	121,238
1859-60	120,086	1870-71	112,118
1860-61	182,233	1871-72	112,237
1861-62	88,910	1872-73	178,660
1862-63	132,684	1873-74	195,807
1863-64	207,646	1874-75	193,164

The annual production of cotton lint in Coimbatore is estimated to be about 22,000 bales of 400 lbs. each. The consumption of cotton within the district is estimated at 5,000 bales, leaving about 17,000 bales for export. The cotton produced is chiefly sent to Beypore for shipment.

Very little cotton is grown in the northern and western portions of the district. The largest area is grown in the taluqs of Erode and Darapuram.

The black and red soils are usually preferred for cotton cultivation probably because these soils are capable of taking up and holding a large quantity of atmospheric moisture, which enables plants growing upon them to survive the effects of a long drought. Clear dry hot weather must be secured for the cotton harvest in order to obtain a good yield of lint, both as regards quality and quantity. The weather experienced in Coimbatore during the months of January, February, and March is particularly favourable for the cotton harvest; but, from its extreme dryness, plants growing on soils, approaching in composition sandy soils, die off; hence, in order to secure his cotton harvest, in this dry weather, the ryot is compelled to sow cottton on moderately retentive soils. Mr. Schiffmayer's experiments, referred to in the accompanying Report of the Sydapet Experimental Farm, shows that a black cotton soil is capable of holding more than one-third of its entire weight of water; and that it has, in a very remarkable degree, the power of absorbing moisture from the air; he found in an ordinary cotton soil 9·43 per cent. of moisture, and in one of sandy soils of the Experimental Farm only ⅔ per cent. of moisture after both soils had been equally air-dried; and he found further that the air-dried samples on exposure to the atmosphere during night absorbed—the black soil, 1¼ per cent. of moisture, and the sandy soil only ½ per cent.

In portions of the district watered partially by the rains of both monsoons I am inclined to think that the calcareous soils will, under the rude agricultural practice of the district, yield heavier crops of cotton than the soils on which it is usually grown. The celebrated crop, grown by a former Collector of Coimbatore, Mr. Wroughton, which, on 30 acres of land, yielded 25,000lbs. of seed cotton, was produced on a calcareous soil resting on a crystalline limestone. Mr. Wroughton attributed the large crop to the effects of the favorable rains which the land secured from its position directly opposite the Palghaut gap, and therefore securing the benefits of the rains of both monsoons, I had an opportunity of inspecting this land, and would attribute the large crop to the quantity of lime the soil contains, quite as much as to the favorable climatical conditions of the neighbourhood. However, calcareous soils are not met with to any great extent, and such soils, if situated in the drier parts, would not be likely to produce good crops of cotton unless aided by irrigation water. Both the black and red soils would, I am sure, yield very much larger crops of cotton if manured with lime. It is true that some of the black soil contains nodules of limestone, but the action of lime in this form is exceedingly slow and very limited in comparison with the action of lime that has been prepared by burning. Cotton is sown generally in the months of September and October, and the crops are gathered during January, March, and April. Those I saw were very poor indeed; the people said that an average crop was from 200 to 250lbs. of seed-cotton, which gave from 50 to 60lbs. of clean lint. I certainly saw no crop that seemed likely to produce more than 70 or 80lbs. of clean lint per acre, and I saw considerable areas of land under cotton from which it seemed to me probable that the yield of clean lint would not be 50 lbs. per acre. Coimbatore cotton is noted for its whiteness; but its staple is very short. I learn that there are yet traces in the cotton from some portions of the district of the Bourbon and New Orleans varieties that were introduced by the Government cotton farms upwards of 30 years ago. However, the traces are but slight, which perhaps is not surprising, seeing how cotton culture is conducted by the ryots. Cotton is grown, year after year, on the same land. Cotton land is *never manured*, and not only is the seed and lint removed, but also the whole of the plant. The cotton seed is given as payment for cleaning the cotton, or it is sold; it is rare indeed that it is used for feeding the cattle attached to the land on which it was raised. Much of the seed is consumed by the cattle employed on the roads, chiefly by those employed in connection with the Neilgherry traffic, and a considerable quantity of the seed is sent to the Neilgherries. Cotton cultivation appears to be very unpopular, I was frequently informed by ryots that they look upon cotton as a *very unprofitable crop*. That this should be so is not surprising if, as is generally stated, the yield of clean lint throughout this district is on the average less than 50lbs. per acre, for *the 50lbs. would not be worth more in an average season than Rs.* 10; and it must be remembered that, unlike the majority of the crops grown by the ryot, the cotton crop yields no fodder for cattle, while it is an expensive crop to harvest. I inquired frequently from the ryots why, if the cotton crop paid so badly, they occupied their good soils with it to such a large extent. Their general reply was that they grew the cotton in order that with it they might pay the assessment on their land. I asked why they could not grow grain which would give a larger money return on land of the quality required by cotton In reply they said that, if they grew nothing but grain, *they would have nothing wherewith to pay Government rent, as they and their families could and would consume the whole produce of the land*; they having to content themselves at present with only two meals of food per day instead of three; *that, as they could not eat cotton, it was therefore available with which to raise money for paying their rent.* They asserted that most of the ryots who hold less than 10 acres of dry land could consume in their own families all the grain their land produced. I asked how men who grew no cotton whatever managed to live and pay their annual rents. To this they replied that men who had no cotton land frequently had wells, and with the aid of the well water they grew tobacco, chillies, &c., by the sale of which they raised money to pay the rent; and where there were no wells, the cultivators bred cattle for sale, from the proceeds of which they obtained money to pay the rent. There is, I think, a good deal of truth in this. However, it should be remembered that under the system of barter practised, the ryot can with grain procure everything he needs as readily as if he had the money the grain represented: hence his domestic demand for grain may be much larger than would suffice for the actual food of his household. In the open market cotton is as easily bartered away, but for the every-day wants of the family cotton is not nearly so acceptable an exchange as grain.

On an ordinary holding of 10 acres of unirrigated land, farmed in the usual way, the crop would not yield more than 1,500 Madras measures of grain in the year, which, deducting 10 per cent. for waste, &c., would represent an allowance during a year of about 3¾ measures per day. In the Coimbatore Jail the food allowed to each male adult consists daily of—

	Ounce.
Cholum...	24
Dholl	2
Mutton	5
Vegetable	6
Salt and condiment...	5
Total daily...	42

The total allowance of food is 42 ounces, but it must be remembered that the grain is without husk. Adding this, the total daily allowance amounts to fully 46 ounces, which would be about the weight of 1-1/5 measures of cholum or cumboo, which would not contain so much nutriment as the jail allowance. In a family of 2 adults and 4 children fed on cholum or cumboo, the daily consumption at 1-1/5 measures for an adult male, and 4/5 of a measure for an adult female, would be for the parents two measures, and about 1-1/5 measures for the children, total daily consumption 3-1/5 measures. From this it would appear that the produce of the 10 acres would be just sufficient to feed the family throughout the year, and leave a trifle for bartering for cloths, &c., if the members of the family were as well fed as the convicts usually are; but in that case there would be nothing available for the payment of rent, &c., hence the necessity for restricting the diet to two meals in the day, and in this way setting free ⅓ of the money value of a full diet for the payment of rent and the other charges which even the humblest ryot has to meet. It will be seen thus that there are good grounds for believing the statement made by the ryots, noticed in the preceding paragraph. Cotton might be produced to any extent in the district of Coimbatore; the climate is admirably suited for cotton culture, and there are large areas of soils which would produce it heavily under good farming.

The next important crops are the pulses—horse-gram (*Dolichos uniflorus*), mutchehcottay (*Lablab vulgaris*), Bengal gram (*Cicer arietinum*), black gram (*Phaseolus Roxburghii*), green gram (*Phaseolus mungo*) Dholl (*Cajanus Indicus*). Together these pulses occupy annually about 220,000 acres of land. Horse-gram is the most important; it occupies about three-fourths of the entire area under pulses. Horse-gram is grown to some extent in all the taluqs, but chiefly in those of Palladum and Coimbatore. There is a large demand for this pulse for the hill markets. Mutchehcottay occupies the next highest area, about 25,000 acres; it is grown chiefly in the taluq of Darapuram. The area under the other pulses referred to is, in each instance, about 10,000 acres annually.

The cereal crops shamay (*Panicum milliare*), tenney (*Panicum Italicum*), and varagoo (*Panicum* [illegible]) are grown to some extent. Together they occupy, in the year, about 150,000 acres. Shamay is grown in all the taluqs, but chiefly in those of Coimbatore and Palladum. The cultivation of tenney is confined almost entirely to the Coimbatore taluq, and that taluq also produces the largest area of varagoo.

The area annually under crops that produce seed yielding oil is about 80,000 acres. The varieties chiefly grown are gingelly and castor; the former occupies about 55,000 acres, and the latter about 25 000.

Several other crops are grown on the unirrigated arable land; but from the small area they occupy, they are not of much importance.

An exceedingly small proportion of the occupied area is under grass. I saw some fair pasture near Othikkalmundapum in the Coimbatore taluq, and also a few patches of middling pasture in the Pollachy and Kongiem taluqs; but elsewhere in the district, excepting on the slopes of the Annamalays and Neilgherries, on the banks of the larger rivers, and, on the margins of irrigated land, I saw nothing that could be called "grass land." Over the greater part of the country, there is not in each 1,000 acres of occupied land more than one acre under pasturage.

The almost entire absence of pasture land is a serious defect in the agriculture of this district. The temporarily abadoned arable land is recognized as "*grass* land" in the revenue classification; this is, I think, a grave error, for it is calculated seriously to mislead. In all countries "grass land" is understood to be land which is covered by grass, either throughout the whole year, or during a considerable portion of the year. Now, much of the so-called grass land in the district is altogether without grass, being almost as bare as the highway. A country which has a large area of *grass* land is in a much safer condition than a country in which all the lands is under arable husbandry. We are told that "*grass* land" occupies, at the least, 10 per cent. of the occupied land of this district. Such a statement does no harm when it is understood that this so-called "grass land" may be land which is altogether destitute of grass; but without this special knowledge the statement is certainly misleading. I saw a good deal of this so-called "grass land," and much of it would not, I am sure, yield a barrowful of grass, roots and plants included, per acre. The season had certainly been an unusually dry one, However, this would not account for the poverty of vegetation on the land. In some instances land is specially sent apart by the ryot for the production of grass. I saw some of this land which had been so reserved for periods varying from 10 to 30 years, and in no instance did I see anything approaching a sward. In most instances the grass grew in low tufts which were scattered over the ground at distances of from 6 to 12 inches, the intervening spaces being quite bare. The grasses seemed generally to be perennial species I seldom saw annual grasses or other annual plants growing amongst these grasses. I saw one piece of pasture land which had been under grass for more than 30 years; and I am quite certain that if the whole of the produce on the land was *scraped* off, it would not have amounted to 200 lbs. per acre. The ryot never manures his pasture land, and he crops it incessantly with cattle, sheep, and goats as long as these animals can obtain a scanty support on it. The only time when this pasture land is allowed rest is during and after heavy rain, when the grass, which then springs up, is considered to be noxious to live-stock. The grasses are thus never permitted to produce seed, or only to a very limited extent, and hence much of the ground remains bare. Ryots know nothing whatever about raising grasses from seed. When pasturage is desired, a piece of arable ground is left untilled, and in the course of a few years it becomes covered here and there with scanty tufts of herbage. No attempts are ever made by planting the roots of grasses, or by sowing the seeds of grasses, to improve this scanty pasturage. Not only are the circumstances bad under which land is laid down to grass, but the whole of the subsequent management of the grass is the very opposite of that under which good results might be achieved. Land when once covered by a scanty pasturage, such as I have described, is abandoned, as far as acts of husbandry are concerned. The consequence of this management of the grass lands is a serious deterioration in the live-stock. It would be impossible that anything else but deterioration could result to live-stock raised on these exhausted grass lands. If the grass does not in itself afford the food required by the stock during growth, and the special food required is not supplied by other means, the *result must be an animal of stunted and imperfect form.* Ryots speak with pride of a period 20 or 30 years ago when they possessed fine breeds of cattle and horses, the loss of which they attribute to the almost total disappearance of grass in the cropping of the district. Ryots complained bitterly about a change in the assessment of land, made some years ago, under which most of their best grass lands were brought under the plough I have not been able to procure any exact data, but the assertion generally made was that before the change in question took place ryots were permitted to hold grass land at one-fourth of the rent paid for tilled land without fear of any one taking the land from them. I understand from information afforded me by the Board of Revenue in their Proceedings, No. 3044 of the 2nd December 1876, that ryots are still permitted to hold the so-called "grass land" at one-fourth the annual rent payable for their arable land, *provided no person is willing to take up the land for arable culture at the full rent.* The effect of these rules is to restrict grass to such soils as are not, in the estimation of the ryot, competent under arable culture to afford even that wretched return with which he is usually satisfied, and *to induce the breaking up of grass land whenever its condition is such as to promise a good return under tillage.* Under circumstances such as these it is not surprising that goood pasturage should be unknown.

To produce a good pasture is a difficulty even in England, where the climate is all that could be desired for the growth of grass. In that country the soil intended to be laid down under pasture is prepared in a most elaborate way: seeds of the varieties of grasses likely to succeed best on the special soils to be sown are selected, and are sown under conditions calculated to secure good results, the soil being previously put into a good manural condition. In the after-management the greatest care is exercised.

In Great Britain much money is expended on labor and manure, under skilful management, in the laying down of land under grass. There is perhaps no work of the farmer which demands to be more thoroughly performed than that connected with the laying down of land under grass for pasture. And yet, in this country, with its unpropitious climate, the production of pasturage is supposed to demand nothing from the ryot, but to result from natural agencies, which are not one hundredth part so powerful for good in the direction required than are such agencies in England. Such pastures as we have in England could not be produced in Coimbatore on the unirrigated land, but moderately good pastures could be produced by the ryot if he adopted a better system of husbandry. On the land watered by wells there would be no difficulty whatever in producing good pasturage; there are many grasses well suited for cultivation under such condition as could be afforded. If the ryot could be induced to lay down under grass annually a portion of his land irrigated from wells, and to graze this land by his live-stock, the soil would be improved for the next two or three succeeding crops, and on the removal of these the land might again be put under grass. Or some of the vast volume of water wasted on the paddy crop might be diverted to land on which grass might be produced. The extraordinary crops of grass produced in the neighbourhood of Madras under occasional irrigation shows what can be done in this direction.

Throughout the district, the ryots agreed in stating that the unirrigated land has diminished in productiveness fully 30 per cent. during the past 25 years. Many of the men whom I consulted possessed river-irrigated land as well as unirrigated land, and as these men without an exception, stated most positively that there was no change whatever in the productiveness of the river-irrigated land during the period in question, we may, I think, accept their testimony as true especially as everything tends to support its truthfulness.

I took special pains to sift statements made regarding the deterioration in the fertility of the land, and I could come to no other conclusion but that *this deterioration has taken place, and to a very alarming extent*; while it appeared to me equally certain that the influence which have brought about this result are not only still in operation, but are now operating in much more intensified form.

I have before pointed out that the large area of land which, previously to 1855, was untilled was the reserve which enabled the ryots to treat their arable land in a somewhat better way than is now the usual practice, chiefly by enabling them to keep more stock.

Everywhere where I went the ryots declared that there has been a great diminution in the live-stock of the district. Since returning to Madras, I have carefully examined the statistics of Coimbatore, and I have ascertained that, *in the last 30 years, the area under occupation has been increased* 50 *per cent., while there has been but little change in the number of live-stock*; hence, compared with the area of land now under occupation, there has been a large decrease. The following statement shows this :—

Official year.	Number of ploughs.	Area of occupied land.	Number of head of cattle.	Number of head of cattle per 100 acres of occupied land.
1838-39	71,381	999,334	657,766	65·82
1839-40	73,193	1,024,702	658,261	61·24
1840-41	74,540	1,043,560	654,254	62 69
1841-42	77,758	1,088,612	644,777	59 23
1842-43	79,485	1,112,790	656,369	58·98
1843-44	80,314	1,124,396	659,935	58 69
1844-45	81,918	1,146,852	661,783	57·70
1845-46	83,916	1,174,824	633 726	53·94
1846-47	84,362	1,181,068	628 790	53·24
1847-48	85,531	1,197,431	633 956	52 94
1848-49	86,716	1,214,024	641,735	52·86
1849-50	87,103	1,219,442	655,456	53·75
1850-51	88,055	1,232,770	697,606	56·59
1851-52	88,598	1,240,372	726,192	58·55
1852-53	...	...	...	...
1853-54	...	...	...	...
1854-55	...	...	...	...
1855-56	...	...	...	...
1856-57	*105,339	1,471,746	481,445	32·85
1857-58	...	...	...	...
1858-59	...	...	...	...
1859-60	...	...	...	...
1860-61	...	...	...	...
1861-62	*124,421½	1,741,894	623,935	35·11
1862-63	...	...	...	...
1863-64	...	...	...	...
1864-65	...	...	...	...
1865-66	...	...	...	...
1866-67	*147,289	2,062,046	675,340	32 75
1867-68	...	...	...	...
1868-69	...	...	...	...
1869-70	...	...	...	...
1870-71	...	...	...	...
1871-72	*178,011	2,492,154	773,663	31·94

I was unable to procure the area under occupation in each of the years for the whole of the period to which the statement refers; but as I possessed statistics giving the number of ploughs in most of the years in question, I have been able, to some extent, to supply this deficiency. By multiplying the number of ploughs in each year by 14, I obtained the area of occupied land. It will be seen from the following that each plough represents 14 acres of occupied land :—

Official year.	Actual area under occupation.	Actual number of ploughs.	Area under occupation for each plough.	Average number of acres for each plough.
	Acres.		Acres.	
1861-62	1,776,971	124,421	14·2	14·1
1866-67	2,199,089	147,289	14·9	
1871-72	2,293,926	178,011	13·2	

The number of cattle was determined by adding in each year to the actual number of cattle one-eighth of the number of sheep (8 sheep being estimated as equal to 1 head of cattle). It will be seen that *in the official year* 1838-39 *there were for each* 100 *acres of occupied land* 66 *head of cattle; whereas in* 1871-72 *there were only* 32 *for the same area.* It must be remembered that the average live-weight of one of the cattle referred to is not more than 350 lbs., *which is only the weight of an average-sized Cotswold sheep.*

I must again point out that I do not look upon the increased area of arable land as an evil in itself, but it is undoubtedly a great evil under the circumstances I have mentioned. As long as the arable land consisted only of the more fertile portions of the country, and as long as that arable land was, to a great extent, supported by the manure of cattle fed in the untilled portions of the district, so long were the ryots able to support themselves by their rude agricultural practice. It is clear that if the arable land did not receive fair treatment as regards manure, when there were 66 head of cattle for each 100 acres of occupied land, it cannot receive justice now, when for each 100 acres the number of cattle is only 32. But, not only has the manuring force, as represented by cattle manure, diminished to one-half, but even of that not more than 50 per cent. is now available as manure from the great increase in the use of cattle dung as fuel since the clearing of the jungles. The consumption of cattle dung as fuel is now very large. In many native households in towns fully one-third of the fuel used is cattle dung. From information I have been favoured with it would appear that, in Madras, the consumption of cattle dung bratties amounts to about 100 per mensem, for each adult in many middle-class native households. In a family consisting of 7 adults and 4 children, 800 bratties are used as fuel in a month; in another family consisting of 3 adults the monthly consumption is 400 bratties; in another household, consisting of 3 adults and 3 children, the consumption of this fuel is 400 bratties per mensem; in another, consisting of 4 adults and 2 children, the monthly consumption is 400 bratties; in another, consisting of 2 adults and 6 children, the consumption is 450 bratties per mensem; and in another household consisting of 2 adults, the consumption is 300 bratties monthly. The dung of one average-sized bullock would, in a month, collected during the night only, make about 120 bratties. During the dry season an average-sized plough bullock, and an average-sized cow, yielded at night in a month a quantity of dung that made, in the first instance, 90 bratties, and in the second 120; and during some experiments made on the Sydapet Experimental Farm, with the large bullocks used there, it was found that the dung of two bullocks in 2 months made 734 bratties, which was equal to 183 per head per month. It would therefore appear that in many native households the consumption of cattle dung as fuel is equal to that obtained from 1 bullock for each adult forming the household. It is true that this quantity of dung cannot be used in all households, for the cattle in the country would not nearly suffice to meet such a demand. However, the facts show to what a large extent cattle dung fuel is used. As fuel is as costly in most parts of Coimbatore as it is in Madras, and as the habits of the people are similar, there cannot be a very great difference in the quantity of cattle dung used; if there is a difference, the probability is that the consumption of cattle dung is greater in Coimbatore from it being more accessible to the people.

Few people have any idea of the enormous consumption of fuel in our rural districts. I was informed at one small town that its population, under 7,000, used monthly 4,000 bundles of 50 lbs. each of jungle fuel, which is equivalent to upwards of 1,000 tons per annum, or the produce of at least 100 acres of well-grown scrub jungle. Besides the jungle fuel referred to the inhabitants of this town used a large quantity of cattle dung, the stems of cotton plant, &c. These figures show that the average monthly consumption of jungle fuel per inhabitant of the town is 28 lbs.; in the Coimbatore Jail the monthly consumption of fuel per prisoner is 60 lbs.

As a general rule ryots do not readily admit, when asked for the first time, that they do not use manure; it is only after a judicious cross-examination that the fact, that they do not use it, excepting, to a very limited extent, is brought to light : thus :—

Q.—Do you use manure ?
A.—Yes.
Q.—What sorts of manure do you use ?
A.—Sheep manure and cattle manure.
Q.—Do you use any other kinds of manure ?
A.—No ; excepting occasionally a small quantity of village sweepings, and, for wet land, Koliujy and Auvaray leaves.
Q.—How many acres do you hold ?
A.—Forty.
Q.—Is it all arable land ?
A.—Yes ; all ploughed.
Q.—How many sheep and how many head of cattle have you ?
A.—Twenty sheep and six head of cattle.
Q.—Do you use cattle dung as fuel ?
A.—Yes.
Q.—What proportion of the cattle dung do you use as fuel ?
A.—About half.
Q.—How do you manure your land with the dung of the sheep and cattle ?
A.—We generally fold the sheep and cattle on the land in pens at night.
Q.—Are the whole of your sheep and cattle kept in one fold ?
A.—The sheep are all in one fold and the cattle are generally tethered to the fold on the outer side.
Q.—Do you give your sheep and cattle any special food when folded on the land ?
A.—Not the sheep, but the cattle get a little cumboo or cholum straw.
Q.—What size is your fold ?
A.—Seven yards square.
Q.—The cattle I observe are tied outside of the fold ; is this always the case ?
A.—Yes, generally.
Q.—Then the area manured by the cattle tied outside of the fold and by the sheep within the fold must be equal to about 100 square yards, which will represent the area manured between each time the fold is removed ?
A.—Yes.
Q.—How often do you remove your fold ?
A.—Every second day.
Q.—Then it is evident that you will manure only 100 square yards of land in 2 days or, in a month, 1,500 square yards, or in a year less than 4 acres. How do you manure the remainder of your land ?

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* Now counted only every fifth year.

A.—We cannot manure it; it goes without manure.

Q.—But you said that you manured your land; whereas the fact appears that nine-tenths of it is unmanured. How do you explain this?

A.—I have 8 acres of garden land, and this gets the whole of the manure I never manure dry land. Dry land is never manured, unless when the cultivator only has dry land, in which case his dry land gets what manure he has.

Q.—Then you mean to assert that dry land is never manured except under the exceptional circumstances you have mentioned?

A.—Yes. All the manure goes to the garden land; the dry land is cultivated without manure.

The foregoing is compiled from notes taken at conversations held with ryots, and is representative of many.

It was only by putting fact with fact that I was able to come to any conclusion on many of the questions that presented themselves during my investigations. After having ascertained the number and description of stock kept in, or at a fold, the number of these folds on a holding, the area manured between each removal of the fold, and how long the fold remained in one place, it became a very easy matter to calculate how much land could be manured in the year on the holding.

I measured many sheep-folds; the majority of them covered an area of only 50 square yards, and, on the average, they contained 20 sheep and goats of all ages. In addition to the animals inside the fold there were, on the average, 8 head of cattle tethered on the outer side.

The sheep of the district are used almost entirely for manuring purposes. There were in 1871-72, 850,227 head of sheep and goats; dividing these in pens of 20 each, 42,511 would be required; the animals at each pen, inside and outside, would together manure 100 square yards of ground. We must therefore multiply the number of pens by 100, which gives 4,251,100 square yards, or 878 acres as the area manured in 2 days. assuming that on the average each pen is moved every second day, From these calculations it would appear that, if folding was practised universally throughout the district on the arable land, *only 158,000 acres of land could be manured in the year*, and that, to do this, the whole of the sheep and goats and one-fourth of the cattle would be required. Making every allowance for the dung of the remainder of the cattle stock available as manure, and deducting the manure lost at the seasons of the year when folding is unadvisable or impossible, it is clear that the *ryot cannot manure in the year more than* 200,000 *acres of land by the dung of sheep and cattle.* Assuming that the efficacy of the manuring obtained from folding operates during 2 years, there will be altogether not more than 400,000 acres benefitting from the manure of sheep and cattle, *leaving more than one and three-quarter million acres of the unoccupied land altogether unaided by manure*: thus 75 per cent. at the least of the occupied land is never influenced by manure. It must not be supposed that the 25 per cent, except the portion irrigated from rivers, is manured in a satisfactory way; the foregoing calculations take no cognizance of the *quality of the manuring*; they show only the area that can be manured under the practice generally followed in folding. I have alreay directed attention to the imperfections of the folding system.

The ryot of Coimbatore knows nothing whatever of the use of mineral manures. The soils greatly need lime, potash, and nitric acid; yet these plant-foods are never directly applied to the soil by the ryot, even though lime and saltpetre are available at prices sufficiently low to justify their use: indeed, so moderate is the price of saltpetre that it is being largely exported for use as a manural agent. If it pays the British and Continental farmer to use Indian saltpetre as a manure, surely it would pay the Coimbatore farmer to use it to some extent, at any rate in the production of those more valuable crops, tobacco, sugarcane, wheat, &c., which feed so largely upon potash and nitric acid, and which are now grown to such a very limited extent, not from any fault in the climate, but from the general neglect of manuring. It is true that the ryot cannot afford to use these expensive manures in raising crops of the inferior cereals, but in the cultivation of the crops I have mentioned they can well afford to use them.

SORGHUM SACCHARATUM.

(*Concluded from page* 96.)

(MR. F. G. WIGLEY'S REPORT.)

IN his next experiment, in 1873 Colonel Boddam sowed in May. He sowed an acre of what he termed "average land" with 20 lbs. of seed on the 25th of the month, and thus described the culture:—

> "The land having been heavily manured, one simple ploughing with the native plough was followed by the country harrow. The seed was then sown broadcast, and the harrowing continued till the seed was covered. When the crop was about six inches high it was thinned by a harrow being drawn over it, as is done in raggy culture at the same stage of growth. No further culture was needed, the sorgho growing so rapidly as to smother all weeds and grass. As the canes began to show flower they were cut in succession, affording two cuttings from each plant, spread over a period of about three weeks. By the end of 2½ months the crop was cleared off the land, which was then broken up for another rotation crop."

An acre of land was at the same time sown with *kaka cholum* (white cholum, a variety of the *Sorghum vulgare*, which the ryots at Bangalore grow in the rainy season as a green forage crop) in order to compare the outturn with that of the sorgho; and the sorgho turned out the best, the yield having been 9 tons, or 20,160 lbs. of green fodder, which was cut between the 25th July and the 10th August, valued at Rs. 54-12-9; while the yield of fodder from the cholum, which was not ready for cutting till the end of September, was 7 tons, or 16,560 lbs. only, the value being Rs. 45. The total cost of cultivating the sorgho was Rs. 21-12, leaving a profit on the crop of Rs. 33-0-9; and of the cholum Rs. 21-6, leaving a profit of Rs. 23-10.

In the above experiment one-third more manure was spread on the land for the sorgho than for the cholum, as the land under the latter crop was superior to that under the sorgho; and the crop yielded about one-fourth more in fodder, besides being cut in 2½ months instead of 4 months as with the cholum. After the sorgho was cut the land was broken up and another crop grown on the same plot during the same season.

The above, Colonel Boddam explained, does not show the *largest* outturn either crop would under ordinary conditions be capable of giving, as the season was an unfavourable one, a long drought having ensued after the first rains, which was followed by very heavy continuous rain towards the end of the experiment.

In recording this experiment Colonel Boddam thought that though, as dry fodder, raggy and paddy-straw were preferable, as a green fodder plant sorgho was most valuable—growing at the time that dry fodder is very scarce and very expensive, being relished by cattle, and being of very rapid growth, more so than the ordinary cholum; besides that it could be grown almost all the year round.

An experiment with sorgho was made at the Lal Bagh, in Bangalore, in the same year, 1873 Mr. Cameron, the Superintendent, sowed the seed, from 15 to 20 lbs., on an acre of land in the month of November; but he thought there was no reason why the date of sowing should be limited to any particular month, as the quality of the ground and peculiarities of climate throughout the different parts of India would suggest their own seasons. The soil was slightly manured and the crop came up very thickly, so much so that Mr. Cameron thought that from 12 to 15 lbs. of seed would be sufficient to sow an acre. Mr. Cameron said that the plants decidedly object to much moisture, either at their roots or on the foliage, and he thought that they should be exposed to a warm sun during the ripening period, as when this is the case the grain swells out considerably, thereby adding to its weight and value. The crop was reaped in the beginning of February, and yielded 825 lbs. of seed and 5 tons of fodder (not stated as green or dry). The expense of labour, Mr. Cameron observed, does not exceed that of putting down any ordinary crop, provided the ground is in a cultivated state.

The above were the only experiments of any value in Mysore. The experiments made by the natives who were supplied with seed came to nothing, and were not reported.

The imphee was very favourably reported upon as a forage plant after the experiments made with it in the Bombay Presidency in 1860. Although pronounced unable to compete with the ordinary sugarcane as a sugar-producer, the imphee was admitted to be of great value as a forage plant. Mr. N. A. Dalzell, the Superintendent of the Dapoorie Botanical Gardens in Bombay, who reported on these first experiments in the Presidency, while having a high opinion of the imphee as a sugar-producer, thought "that if it was regarded simply as a forage for cattle of the most superior description, it would be desirable to persevere in its cultivation." The imphee karbi realised in the Poona experiments, he said, went five times as far as the ordinary karbi.

On the revival of experiments with the Chinese sorgho in 1872 the most sanguine expectations were formed of the plant proving a valuable addition to the fodder crops of the Presidency. Some experiments made at the Botanical Gardens at Gunesh Khind in 1874 were very successful. Mr. Woodrow, the Superintendent of the Gardens described sorgho as a kind of millet, distinguished from the varieties of jowar that are cultivated in the Deccan by the flower panicle being open and loose and the testa of the seed dark brown or black and shining. Mr. Woodrow sowed seed of the sorgho on the 25th March at the rate of 30 lbs. to an acre. On four plots, out of seven sown, the yield of green forage was per acre 10, 11½, and 14 tons; equivalent when dried to 4, 4 2/5ths, 4 3/5ths, and 5 3/5ths tons, respectively. The plant on the other three plots did not turn out well. The soil used was a very poor exhausted black soil, but it was very heavily manured for the sorgho, and the crop was grown as an irrigated green forage crop.

In a further experiment, in which the seed was sown later in the year, *viz.*, on the 10th June, and on unmanured land which had lain fallow for a number of years, the crop being treated in the same way as jowaree, the yield was at the low rate of 12 cwts. of dry fodder per acre, the yield of seed, which was not allowed to ripen, being estimated at 2½ cwts. The value of the fodder and seed was estimated at Rs. 10 and Rs. 26 respectively per ton, and the following comparison with the average yield in the district and profit per acre of bajra and jowar was made:—

	Rs.	A.	P.
Sorgho.			
12 cwts. fodder, at Rs. 10* per ton	6	0	0
2½ cwts. seed, at Rs. 26* ,, ...	3	4	0
	9	4	0
Cost of cultivation and rent per acre	6	0	0
Profit per acre	3	4	0
Bajra.			
8 cwts. fodder, at Rs. 6 per ton	2	6	0
3½ cwts. seed, at Rs. 30†	5	4	0
	7	10	0
Cost of cultivation and rent per acre	6	0	0
Profit per acre	1	10	0
Jowar.			
10 cwts. fodder, at Rs. 9 per ton	4	8	0
2½ cwts. seed, at Rs. 28†	3	8	0
	8	0	0
Cost of cultivation and rent per acre	6	0	0
Profit per acre	2	0	0

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* Estimate of value.

† Poona prices in November 1874.

In his report on the above experiments Mr. Woodrow wrote as follows :—

"Sorgho has been introduced into this district several times during the last 80 years,[‡] and recommended as a sugar-yielding crop, a character which, although deserved, is of little value where sugarcane flourishes. The seed having a hard black testa, and yielding a bread which does not please the eye, has prevented its being taken up by the natives as a regular crop ; and the high value of the forage is a matter which does not command immediate attention. Persistent cultivation on Government farms will certainly bring it into use, and the advantage for fattening cattle can scarcely be estimated."

In the District of Dharwar the experiments were a failure, and sorgho was called " a poor imitation of shaloo, or white jowar." In Khandesh it was not thought worth while to cultivate sorgho, as grass there is plentiful and cheap. Sorgho was in Khandesh compared unfavourably with jowar, " of which, indeed," it was said, " it is merely a black variety."

The climate of Sind appears to be particularly suited to the cultivation of sorgho. There were excellent results to the first experiments made with the imphee in Sind in 1860 ; and the later experiments in 1872-74, with the Chinese sorgho, were also very satisfactory.

The Superintendent of the Model Farm at Salaru, in the Hyderabad Collectorate, made experiments in 1872, 1873, and 1874. In 1872 he sowed only 10 guntas of land, and obtained a yield at the rate of 82 lbs. of seed and 13,038 lbs. of green fodder to the acre. In 1873, sowing on the 24th June, he obtained 935 ¾ lbs. of seed and 9,774 lbs. of green fodder, reaped on the 6th October, to the acre. Two sowings were made in 1874. From the first sowing, of 2 acres, in the beginning of June 1874, the yield was 75,432 lbs. of fodder, with a second cutting from one acre of 1,409 lbs., being at an average per acre on the sowing of 38,420 lbs. of green forage.

From the second sowing in 1874, of 2½ acres, between the 17th and 28th July, the yield obtained was 8,198 lbs. of green fodder, or at the rate of only 3,279 lbs. to the acre. Compared with bajra cultivated at the farm, the following are the results of the cultivation of sorgho :—

	Bajra.	Yield per acre.	Value at bazaar rate.	Sorgho.	Yield per acre.	Value at bazaar rate.	Remarks.
		lbs.	Rs. A. P.		lbs.	Rs A. P	
1872.	Seed ..	1,066	28 8 10	Seed ..	82	0 13 8	
,,	Fodder ..	1,886	8 1 9	Fodder ..	13,032	21 7 11	
1873.	Seed ..	790	21 2 7	Seed ..	93¾	25 1 2	
,,	Fodder ..	5,678	9 5 10	Fodder ..	9,774	16 1 4	
1874.	Seed* ..	418	11 3 0	Seed ..	..	....	* The yield of bajra in 1874, it was explained, was very low, the sowing having been made too late in the season.
,,	Fodder ...	3,293	5 0 11	Fodder ..	38,420	63 6 0	
				2nd sowing Seed ...	..	....	
				Fodder ..	3,279	5 6 6	

The seed of the sorgho and bajra is here valued at the same rate, viz., about 9 annas for 21lbs. The sorgho fodder is valued at Rs. 100 per bundle of about 450lbs.—a higher rate than the bajra fodder.

The first sowing of sorgho in 1874, the Superintendent of the Farm remarked, was the most luxuriant of any cereal crop ever raised on the farm. A crop was cut in a partially green state daily as required for the cattle. The average height of the crop was 11 feet and some of the stems measured over 14 feet, After September the crop was much damaged by insects, and the forage lost some of its richness in consequence. The land had been well manured and ploughed with the English plough during the cold weather, and the sowing and after-culture adopted was the same as for bajra or jowar. The cost of raising a crop of either sorgho, bajra, or jowar, the Superintendent remarked, would be almost the same and "all of them like rich ground and there is no difference in the culture." The opinion of the Superintendent of the Farm regarding sorgho was as follows :—

" The grain is unsaleable here. The karbi would, during the early part of the season, bring about the same money per 100 bundles as would jowar grass. It is best suited for an early fodder crop ; after the culms become mature, insects destroy it on account of the sweetness of the juice. For a general crop it is inferior to either bajra or jowar, but superior as an early fodder crop for use during the hot-weather cultivating season. An early sowing on well-manured land will give a cutting every third month, that is, two cuttings during the season. Working cattle require less oil-cake and cotton-seed to keep up their working powers when fed on sorgho, than they do when fed with bajra karbi."

The native cultivators in Sind, who received seed for experimenting for the first time in 1874, all agreed that sorgho was a good fodder crop for the early part of the season, and the Superintendent remarked that they seldom give so favourable an opinion of any new crop as they had done of the sorgho.

Sorgho, however, may not come into extensive cultivation in Sind, as its grain is not valued ; and, as the Collector of Hyderabad observed, the Sindhis do not cultivate any crop merely for forage, the staple food for cattle—the stalks of the jowar—being, in their opinion, preferable to anything else which would not produce grain as well as grass. It might, however, it was thought, be more appreciated in the neighbourhood of populous towns and villages, where there would be a market for its grain ; and it was proposed to distribute seed among the cultivators in such localities with a view to ascertain whether sorgho would find favour as an addition to the few varieties of fodder which Sind possesses.

Some experiments were made by the Commissariat Officer at Deesa in the Bombay Presidency. That officer, attracted by a notice in the *Times of India* regarding the value of sorgho as a forage plant, obtained seed from Colonel Boddam at Bangalore with a view to making experiments. On the 1st April 1872 he sowed 8¼lbs. of the seed with which Colonel Boddam supplied him on a piece of land measuring 682 square yards. The soil being of a light sandy description, it was plouged to a depth of 2 feet and well manured with sheep dung ; grain had never been grown on it before. The quantity of seed realised from the crop was small—31lbs. only ; but the green karbi produced, which was cut between the 23rd and 28th July, weighed 4,605lbs., being at the rate of 32,680lbs. per acre. The probable value of the karbi, the Commissariat Officer thought, was Rs. 23 reckoning it at Rs. 5 per thousand pounds ; and he said that " the karbi grown seemed first rate, and is a very sweet and nourishing fodder for the slaughter cattle, which relished it much."

Experiments have not been made to any large extent in the Bengal Presidency. In 1872, Dr. Henderson, who was then officiating as Superintendent of the Botanical Gardens at Calcutta, made an experiment with two pounds of seed, which he sowed on the 17th July on a piece of ground measuring 1,680 square yards. The yield was 5,800lbs. of green fodder, cut between the 13th August and the 30th September, and 3,680lbs. as a second crop, cut in October ; or a total yield of 9,480lbs. being at the rate of 27,311lbs , or rather more than 12 tons to the acre Dr. Henderson gave the following information regarding the plant :—

" I believe it has been repeatedly tried for very many years in various parts of India, and the reason why it has not yet established itself is probably because it requires a very large quantity of manure, as well as plenty of water. Many years ago I made experiments with it in the Punjab in every variety of soil, and found that it could be successfully grown almost anywhere ; and, if well manured and liberally watered, it yielded a very large quantity of excellent fodder—considerably more, I think, than any other fodder plant with which I am acquainted—and could be cut five or six times during the summer. I also tried to extract sugar from the juice, and made some fair samples, which, as far as I recollect, had this peculiarity, that neither flies nor ants would touch it.

" On questioning the native gardeners here as to the quality of the fodder I was told that it is so injurious to cattle that no one would take it as a gift and that cattle would hardly eat it. It appears that the crop grown here last summer was offered to the villagers about, but they, seeing such fine fodder offered gratis, were naturally suspicious of it, and would have nothing to do with it. So the next batch was sent to the Commissariat ; but the Commissariat Sergeant, learning that the villagers refused it, declined to let any experiments be made on the Government cattle. I need not say that there is no foundation whatever for this idea that the plant is injurious to cattle. I know as a fact that cattle are fond of it and thrive on it, and the bullocks in this garden are now eating it without any bad effects. I saw fields of the *Sorghum saccharatum* in Eastern Turkistan, near the city of Yarkand, where it was growing ten feet in height.

" My opinion of the plant is that it is one of the very best that can be grown for fodder, where plenty of manure and water can be given. The crop is no doubt rather an exhausting one, and it would just be the thing to grow where sewage irrigation can be obtained, and in saline, as reh soils. If it could once be got to germinate after flooding or draining the land sufficiently I believe it would take up the excess of saline matter faster than almost any other crop."

In September 1873, the Collector of Monghyr reported that some plants that had been grown in the public garden at the place (seed sown in May) had attained the height of 17 feet, but that the natives, although admiring its gigantic growth, did not evince any interest in the plant as fodder for their cattle ; and no applications were made for seed, which they all knew was to be had for the asking. The Collector thought that sorgho, if cut when about six feet high, had much to recommend it as a fodder plant, but he did not think that the cultivation of the plant would be taken up, remarking that " the fact is that setting aside land merely to grow fodder for cattle is an arrangement which does not at all coincide with the views of native cow-keepers."

Some experiments made by the Executive Commissariat Officer at Hazaribagh did not turn out well. The other experiments carried out in the Bengal Presidency were all on a very small scale ; but the reports tended to show that sorgho could be successfully introduced into the presidency.

In the Purneah Districts, a few seeds were sown by Mr. McQueen Sub-Manager of the Durbhunga Estate, in October, and he had four cuttings of the plant in the months of March, June, September, and November following.

In the Chittagong Division sorgho seed sells at 7 pies per lb., and in the Lohardugga District of the Chota Nagpore Division, where about 125 acres of sorgho are under regular cultivation, the seed fetches from Re. 1 to 1-4 per maund, the cost of culture being from 2 to 3 annas.

No experiments were made in Assam.

The most carefully conducted and most successful experiments with sorgho in the North-Western Provinces, and indeed in the whole of India, were those made on the Government Farm at Allahabad. Seed of the Chinese sorgho and the imphee was received on the farm in 1871 and in that and each succeeding year sorgho has been grown with great success and with profit.

In 1871 the sorgho was grown under the rough method of cultivation adopted by the natives, in order to test its value from that point of view as a forage plant, and in comparison with the jowar ; and giving an outturn worth 1-3rd more than the jowar, it was grown again in the following year, on an increased area of land and under an improved system of cultivation. The yield in this year having been highly satisfactory, and the crop having been found a paying one, sorgho was grown again on a still larger scale in the years 1873 and 1874, and with increased profit to the farm in each year ; and it has now established itself as one of the regular crops of the farm. The fact of the Superintendent's cultivating it, as he does, with a view to increase the profits of the farm, speaks very strongly in favour of sorgho cultivation.

In the first experiment, that of 1871, two plots of ground of one-and-a-half acres each were sown with sorgho and jowar. The soil was unmanured, ploughed, and prepared by the native ploughs, and both crops were treated in all respects in the same way as the native cultivators treat the common jowar. The seed, 10lbs. of the sorgho and 15lbs. of the jowar, was sown broadcast on the 27th June; the seeds were germinating freely by the 1st and 2nd of July, simultaneously with both crops; but during the next 14 days the sorgho took a decided lead which it always maintained. Both crops suffered from a severe storm which took place on the 15th of the month, and this somewhat impeded their growth; but on the 4th September the sorgho was nine feet high, while the jowar was only 6¼ feet. By the 1st October the sorgho had reached its full height of from 15 to 15½ feet, while the jowar on the same date was only 8¼ feet high, and did not reach its full height of 12 feet until the end of the month. The two crops, however, were reaped at about the same time, *viz.*, the end of November, as the sorgho took much longer than the jowar to ripen its seed,—and the sorgho was grown specially for seed. After the sorgho was reaped, the plants started and grew away freely from the old stools, which is a great advantage, the Superintendent remarked as affording a deal of green fodder late in the season when fodder is scarce. This point was greatly taken notice of, he said, by the native cultivators in the district. There was no second growth from the jowar.

[‡] This is evidently a mistake. Sorgho was not introduced into India until the year [illegible].

The total yield from both crops in green fodder and seed was as follows:—

	SORGHO.		JOWAR.	
	Yield	Value.	Yield.	Value.
	lbs.	Rs. As. P.	lbs.	Rs. As. P.
Grain	400	6 10 8	640	10 10 8
Karbi, 1st cutting	10,400	16 4 0	8,800	13 12 0
" 2nd "	6,430	11 9	....	......
TOTAL	....	34 7 9	....	24 6 8

The produce of the two crops is here valued at the same rate, *viz.*, a little over 3 pies per lb. for the seed, and, Rs. 1-9 per 1,000lbs, for the fodder.

An attempt was made in the same year to grow sorgho as a cold-weather crop. Seed was sown on the 1st November; it germinated well, and the young plants grew to four or five inches high; but when the cold weather came on, most of the plants dwindled and died out,—only a few which were protected by some plants of barley, the seed of which came in the manure, being left; and these, showing flower at 1½ foot high, the Superintendent thought, conclusively proved that the plant would not succeed in the winter. Sorgho is best cultivated in Upper India in the hot weather and rains. Several attempts to grow it in the North-Western Provinces as a cold-weather crop have failed.

Mr. Phillips also made a trial with the African imphee. Seed was sown on the 3rd July, but the plants grew to the height of 3½ feet only, and the outturn was only about 1-8th that of the Chinese sorgho grown in the same year. Mr. Phillips thought that the imphee was not to be compared to the Chinese sorgho as a fodder plant. According to his experience "the true sorgho (Chinese) grows from 17 to 20 feet high, while the imphee never attains half that height." Mr. Phillips said that he had seen a crop of imphee at Buxar in 1874, which was being grown for the Government stud there, that had only attained five feet in height and was yielding only 150 maunds of karbi to the acre, while the Chinese sorgho on the Allahabad farm was at the same time yielding at the rate of 600 maunds to the acre.

* * * * * *

The experiments that have been made in India prove that sorgho will grow and thrive in any part of the country; and that if brought under general cultivation the advantage in affording nourishment to cattle and improving their condition would be great. As in other cases, however, the cultivation has not been allowed to pass beyond the experimental stage. Sorgho has been proved to be an excellent forage plant, and to have special advantages over other plants which are usually cultivated for forage in the country, but it has not been taken to by the natives. All the experiments recorded in this note were made by Europeans, or under European supervision, there having been scarcely a single experiment made by the natives that has turned out of any value, although seed has been widely distributed among them. This cannot be held to reflect upon the value of the crop, as the apathy and indifference of the natives in regard to anything that is new, and especially in the way of agriculture, is well known; and this, besides, is the experience undergone more or less by every plant that has been introduced into the country. Colonel Boddam was fearful of this fate overtaking the sorgho, as will be seen from the following extract from his report on the results of his deputation to Mysore:—

> "I recommend sorgho as an important addition to the forage crops of Mysore, but deprecate desultory experiments, or it may share the fate of many other trials so conducted. Seeds of various kinds have over and over again been distributed for trial in small quantities to District Officers, and handed over to the Amildars, who are apathetic and ignorant in agricultural matters (I state this on the authority of letters from District Officers). No good has ever come of such experiments."

Colonel Boddam thought that experiments should be undertaken on a large scale under European supervision as the only means of attracting the attention of the natives to sorgho; and a very good suggestion, apparently, and one which the Government might think worthy of consideration, is that which has been made by some of the officers who have experimented with sorgho, *viz.*, that the crop should be persistently cultivated on the Government farms and by the Commissariat Department for some years together, when the subject would be brought practically and forcibly to the notice of the native cultivators; and this really appears to be the only means of inducing them to take an interest in sorgho cultivation. The cultivation of sorgho has been undertaken systematically by the Government of the Punjab. Experiments are annually being made in the Government and jail gardens, and a stock of acclimatised seed is from this source made available and kept for distribution to any who may ask for it.

Sorgho does best in India in moist climates, although it is hard enough to grow almost anywhere; and it has been found that irrigation is necessary for a good crop wherever rain is not plentiful. Sorgho will do well without much manure and on poor soils, but with manure and water it comes to great perfection and is a highly profitable crop. It is a good crop under the most ordinary cultivation, and it can be cultivated exactly as jowar is by the natives. It very closely resembles the jowar in habit and growth, and should be cultivated at the same time of the year and under the same conditions as that crop is, any additional care that may be bestowed upon it in cultivation being repaid by a large increase in the yield. The seed will germinate in India almost at any time, but the best time for sowing has been found to be May or June, and, if grown as a cold-weather crop, October. If cultivated only for forage, it appears that sorgho is one of the very best crops that can be grown in India, and superior to the jowar, but its yield of grain is not so certain or usually so large as that of the jowar, and this has been given as a reason for sorgho not having found favour with the natives in many districts.

Sorgho forage has very generally been admitted to be superior in nutritive qualities to either jowar or bajra forage, but there have been very many instances in which it has fetched a lower price than the ordinary karbi, the natives being suspicious of it and not caring to use it on account of its being new and unknown to them. Sorgho seed is now valued on the Sydapet Farm at 9¼ pies per lb., the seed of the yellow and white cholum, the rivals of sorgho in the Madras Presidency, being valued at 5 pies and 6 pies per lb., respectively. The seed sells in England at from 1*s.* to 2*s.* 6*d.* per lb., and in Australia at 6*d.* per lb. Seed has been regularly distributed to applicants by the Superintendent of the farm, who, on the 31st March 1875, had 7,298 lbs. in stock for distribution. Some officers who have made experiments found sorgho plants to deteriorate after two or three years' cultivation: this may be attributed in many cases to hybridization with the common jowar, to which the sorgho is very apt: sowings of strange seed, too, will doubtless have a tendency to produce the same result, so that it is of importance to obtain, if possible, seed that has been acclimatised for sowing in particular districts.

The extreme sweetness of the sorgho stalks renders them liable to the attacks of insects, and this is certainly an objection to the crop. The seed, too, is sometimes liable to be attacked by a weevil if kept through the rainy season. Birds are very fond of the seeds, and will rob a whole crop of its seed if proper care is not taken to prevent them.

Many attempts have been made in India to extract sugar from the imphee. *Goor* has frequently been made, both by European and Native experimenters; but, owing chiefly to want of care in its manufacture, this *goor* has generally been of inferior quality and of less value in the market than the ordinary sugarcane *goor*. Crystallised sugar does not appear to have been made from the imphee at all, to any extent in India. These failures in sugar-making may, perhaps, be attributed, in part, to the probability of the best saccharine kinds not having been among the six varieties of the imphee originally imported from the Cape of Good Hope into Madras. No information on this head was sent along with the seeds from the Cape. In some experiments made in Bombay in the year 1860, one bigha (2,500 square yards) of land yielded 500 lbs. of *goor*, which was obtained in one hundred days after sowing the seed, the yield of seed when the crop was grown for sugar having been about half that of the common jowar. In some experiments made in Madras also good results were realised; and it was reported that cattle readily eat the stalks of the sorgho after the sugar had been extracted from them. This, indeed, has been found to be the case in America. There does not appear to be any reason why good *goor* should not be made from the Chinese sorgho and the imphee (the red-seeded "Otaheitan" variety particularly) in India. These plants coming to maturity in from 3 to 4 months, while the sugarcane takes usually from 12 to 14 months, their being much easier of cultivation and their stalks being much softer and more easy to crush than those of the sugarcane, give them an advantage over the ordinary cane that might well be turned to account. The value of sorgho as a forage plant is, however, its principle recommendation for India; and the Chinese sorgho, or what is generally known as the "tall black-seeded variety," if its cultivation is energetically taken up, has a great future before it as one of the best forage plants of the country. If sown early it will yield a supply of fodder for use during the hot months when every other kind of grass is dried up, and during the rainy season; and if cut when from three to four feet high it will shoot up again, giving three and even four cuttings from one sowing, a stock of seed for sowing in the following season being obtainable from the latest growth of the plants.

SERICULTURE IN THE DOON.

ALTHOUGH Government has only taken up the question of sericulture in the Doon within the last year or two, the experiment is by no means a new one. Many years ago the late Captain Hutton of Jerrapani and others discerned that the Doon was eminently fitted for sericulture, and they commenced the industry on a small scale. All the experiments made were most satisfactory; cocoons raised in the Doon were pronounced by experts in Calcutta, England, France, and Italy, to be of the very best quality, and finer than anything that could be raised in Bengal. But this favourable verdict resulted in no extension of the experiments to the status of a regular industry; want of capital—the impecuniosity common to most retired officers—was probably the cause of no advance being made. Government has now taken the matter up, and will shortly be in a position to judge fairly for itself. Everything seems favourable to the progress of the experiments; the mulberry tree grows most luxuriantly, the climate is suitable, a true silk worm is indigenous to the Doon, and former experiments, carried on both with Cashmere and Japan worms, have been most successful. The idea of Government appears to be to induce the villagers to take to sericulture. With this object in view, a model farm has been started at Ambiwalla, about seven miles west of Debra; eggs from Japan, Cashmere, and also acclimatized eggs have been hatched there, and the young worms sent out to rearing-houses scattered about the district. In these houses the worms are reared by labourers from the adjacent villages, on daily wages; and the whole are under the personal supervision of the Superintendent of the Doon, who has made sericulture a special study. The cocoons will either be sold or reeled off at the head establishment at Ambiwalla. Next year it is intended to hatch the eggs, and to make over the worms entirely to the villagers, from whom the cocoons will be purchased, at so much per seer, thus giving them an interest in looking after their rearing. The industry is a new one, and all old residents in India know how difficult it is to induce the ordinary native to take to a novelty, unless he is clearly shown that it will pay him well Sericulture requires neither strength, machinery, nor skilled labour, whilst the men of a household are pursuing their usual occupations, the women and children can watch and rear the worms —*Pioneer*

THE GARDEN.

THE roses at Simla just now are very beautiful. A correspondent informs a contemporary that many houses are half covered with them, and "as there are a great many amateur gardeners and lovers of roses here, there would be every chance of a good show, but for the hail, which, in many cases, has done great injury to the buds, but wherever there has been even partial protection, the plants are in fine flower, and a little bright, calm weather will enable all of them to recover themselves by the middle of the month"

FLOWERING STEPHANOTIS IN SMALL POTS—Few sweet scented flowers are more appreciated than those of the stephanotis, either in a cut state or on the plants, and to have them in abundance on plants grown in 6in pots is desirable. This may be accomplished by obtaining strong young plants, and growing them in a moderate temperature, where they can obtain abundance of light, sun, and air In summer they may be placed out of doors in a sunny spot, where the wood will get well ripened. The side shoots should be spurred in to within 1in of the main stem, and when bad weather sets in, the plants should be removed in doors, and then shoots tied up to a trellis near the glass If a little heat be applied in November, shoots will be emitted at every joint, all of which will flower profusely In this way Mr Ley, of Croydon, grows hundreds of small plants, the stems of which, early in summer, are full of bloom from top to bottom, making admirable subjects for indoor decoration. Large plants may, of course, be treated in the same way, all that is required is to treat them exactly as one would vines on the spur system, and abundance of flowers will be the result.

VEGETABLE GARDENING IN INDIA.

(Continued from page 167)

CARROTS.

Daucus Carota

THE soil mixed with sand, should be deeply dug, to enable the the root to penetrate easily. When the plants have four leaves, thin them out to four inches these again may be thinned to ten inches, the space required for a full grown carrot Water freely. Weeds should be removed, as they impede the circulation of air, and absorb the moisture so necessary at the root

When carrots are stored, the crown should be completely cut off, to prevent shooting of the leaves. Carrot seed is very slow in germinating, and may be accelerated by damping the sand with which the seed has been mixed, and allowing it to "chip" before sowing.

CAULIFLOWER.

Brassica Oleracea

In the Lower Provinces, country seed should be preferred to imported seed, for the former had a steadier growth up to the end, and seldom disappoints the cultivator In the North-West, imported seed should be sown in boxes or half casks in August,—the soil should be mellow and rich, carefully drained,—and placed under cover, with light and air. When the seedlings have four leaves, they should be removed to a second cask or box and placed at intervals of four inches: there they should remain until they have eight leaves, when they may be transplanted. In Bengal, acclimatized seed is sown a month later. Beds for cauliflowers are made as for cabbages of the larger kinds they are rank feeders, and require heavy manuring. A weak solution of potash will aid to their growth. Earthing up gives strength and vigour to the stalk, and should not be omitted. Leaves, unless decayed, should not be removed. A later supply of cauliflowers can be had in the Upper Provinces, by sowing seed in September, on raised beds in the open air. Water, growing plants freely.

CELERY.

Apium Graveolens.

The seed should be sown in February under shade, and as the primary object is to keep the plants in a backward state, until the rains are almost over, the poorest soil should be selected; if hot winds prevail, water freely The trenches should be prepared in August, running north and south, eighteen feet in length by two in breadth Dig to a depth of three feet, throwing the earth on either side of the trench, and levelling, as this earth will subsequently be required for earthing up at a later period Place in the trench eighteen inches of good well-rotted manure, above this, six inches of the soil mixed with sand to admit of the young roots penetrating easily to the black soil In September, select the most robust of the plants, and plant them twelve inches apart A second, third, fourth, and fifth trench may be prepared at intervals of fifteen days, taking care always to select the most advanced plants By this method celery may be had in perfection for many months, even as late as June The plants should be earthed up when about fifteen inches high, then allowed to grow and expand as much as possible Fifteen days before the vegetable is required for the table, earth up to within six inches of the top, pack the earth as tightly as possible, to exclude light and air. Never use cylinders of any kind, as they tend to dry the stalk, making it stringy Water freely every fourth or fifth day, taking care that none is permitted to get to the heart of the plant, or it will decay.

LETTUCE

Lactuca Sativa.

The seed should be sown in a well-drained pan under cover, accessible to light and air, in a light rich soil. The earth should be kept moist When the seedlings have two leaves, remove them to the open bed, giving each three inches of room After each removal, water freely Seed may be sown from July to January, but the plants do not mature if planted out before October. Liquid manure increases the size to a great extent, and should be given every ten days. Frequent watering is necessary.

GARLIC.

Allium Sativum

The soil required for this bulb should be rich The usual method of growing is to plant a clove (this being one of the many divisions enclosed in the outer skin) an inch deep, allowing each plant a space of twelve inches It is a peculiarity of the bulb to send up a stem with bulbs, in place of flowers. This should be pinched off, as its growth affects the bulb under ground. Water freely. The plant is matured when the leaves wither and the divisions of the bulb separate easily, when the outer cuticle is removed. Plant the cloves in October

CUCUMBER.

Cucurbita Melopepo.

The older the seed, the stronger the plant. Seed should be sown in a box in February, covered very lightly with leaf mould When they have put out a strong leaf, nip off the stem above the leaf In two or three days after this operation, they are ready for transplanting For a bed, dig a circular hole with a diameter of twelve inches Fill this up with a mixture of sand, garden soil, leaf mould, and well rotted manure, in equal portions The depth of the hole should be twelve inches In this bed, place three plants in the form of a triangle, four inches from each other. When planted, press the earth around them, and give a liberal supply of water When cultivating the indigenous seed, the male blossom should be nipped off, leaving but one or two The vine also should be cut off at the top, as soon as two or three cucumbers have set Sprinkle wood-ash over the young plants to protect them from insects, a thorough dusting on and below the leaf is necessary. A good turf fire, giving volumes of smoke enveloping the plants for an hour or so, renders the leaf unpalatable to the red beetle. For a time water freely, never allowing the soil to become dry.

MUKKA OR INDIAN CORN

Zea Mays.

This vegetable enters largely into native consumption and forms a staple article of food when in a green state among the poorer classes. A succession of crops may be kept up by planting every month from May to January, the more advanced the season, the smaller the heads become. A moderately manured spot should be chosen, and the seeds placed in rows, about fourteen inches apart, giving each a space of seven inches. Where a small quantity is only grown, it is usual to bind several plants together, tying them with their own leaves, as they are occasionally blown down, especially after watering. It is a good plan when the roots appear on the surface to earth them up. Frequent watering is necessary after the rains have ceased

(To be continued)

FORESTRY.

THE introduction of saw machinery into the Canara forests, which is due to the recommendation of Colonel Peyton, Conservator of Forests, has been followed by most satisfactory results—practically as well as financially. Considerable economy is effected in felling, as there is no longer the waste in chips which resulted from the use of the axe. The machines also utilise much timber which the axe failed to bring into the market. The new system has also had the effect of lowering the price of timber in the neighbourhood, and there is said to be a considerable saving to Government in the cost of carrying the timber which was formerly carried long distances in the rough. It appears that the capabilities of the machinery are equal to an annual outturn of 1,11,000 cubic feet of sawn timber, and that, in its present situation, there is enough timber to keep the mill at work for eight or ten years, at the expiration of which period the machinery can of course be moved to a new site. This contingency has not escaped the Government of India, nor has it over-looked the expediency of preparing a carefully considered working plan for the forests from which the timber is drawn.

FROM the last Coorg Report to hand, it appear that cocoa has not taken kindly to the Coorg soil and climate. There is one tree of the *Caroba*, about seven years old, on the *Pollay-betta* Estate in the Bamboo District, which grows remarkably well; it is 15 feet high, and very spreading in the crown, but has not produced flowers. The plant thrives also in Mercara. Perfectly ripe and sweet grapes have been grown in the Central School premises in the open, on a vine which adopted itself to the seasons of Mercara, flowered in November 1876, and produced the ripe fruit in February 1877. The *Eucalyptus globulus*, in its rapid but slender growth, is unable to cope, unsupported, with the high monsoon wind, and succumbs. An attempt has been made to grow it in a close tope, each plant supported by a cinchona tree, and a favorable result is expected. The *Cedrela Toona* or white cedar, in Kanarese, *nagamara*, which grows wild in Coorg, is looked upon not only as a handsome avenue tree, but also as a good shade tree for coffee, and on several estates seed nurseries of the tree have been made. The *Poinciana regia*, a magnificent avenue tree, though introduced more than ten years ago, and growing to stately dimensions in South Coorg, shewed flowers for the first time in the hot season of 1876-77, evidently owing to the long drought. The Moreton bay chestnut (*Cuse tanospermum anstale*) and the *Grevillea robusta*, lately introduced from the Bangalore Government Gardens, do very well in Mercara. Those who have watched from the beginning the truly beneficient undertaking of shading the great trunk roads in Coorg, with wide spreading avenue trees, are much gratified by the steady growth of the well selected trees, chiefly Jack (*Artocarpus Integrifolia*) the varieties of *Ficus* and champaca or sampige.

AGRICULTURAL STOCK.

SHIPPERS of horses for India from Australia are said to be all in the market, making numerous purchases, but prices for anything like good cattle are running very high. Mr. Learmouth has been to South Australia, and had picked up some very well-bred ones, but not having enough for a shipload, was tempted by a good offer, and sold the lot at Adelaide, four of them having been purchased for a team for Sir W. Jervois. At Mr. Yuille's sales, Ailsa Craig, by Castle Hill, was purchased by Mr. Jardine for 120 guineas for India, and Mr. E. Weeks bought a powerful bay colt by Panic Phantasmagori for seventy guineas.

MR. ROBERTSON, the Superintendent of Government Farms in the Madras Presidency, has demonstrated pretty plainly that housekeepers should keep their own cows. Here are the results of an experiment made at the Sydapet Farm. A cow that had a calf on the 6th February, 1876, was milked for 44 weeks consecutively. During that period she gave 3,532 imperial pints of milk. The cow's feeding (including attendance, Rs. 36) cost Rs. 141-15; deduct from this amount Rs. 25, which her calf realised, and the total outlay, was Rs. 116-15—a very moderate price for 3,532 pints of milk. As Mr. Robertson remarks, "1 anna 7 pies per measure for pure milk from your own cow is about 50 per cent. lower than the price which milk, of very inferior quality usually sells for, in the large towns of Southern India."

THE HISSAR CATTLE FARM.

(To the Editor Civil and Military Gazette.)

SIR,—In these days of practical economy by the Indian Government, in consequence of the Bengal, Madras and Bombay famines, when not a rupee is to be expended on public works which can by any possible means be put off for a future time, and when really necessary works such as metalling of roads, construction of travellers' *bungalows* and the like have to stand over till the provision of funds; it is really surprising, a thought has not been given to an *institution* of the Government, yclept the Hissar Cattle Farm. This farm, if I am rightly informed, has been in existence for the last sixty years. Up to I think the close of 1876, it was under the control of the Stud Department, but on the collapse of the latter, it was transferred to the Commissariat Department, and it is, I understand, now under the direct control of the Deputy Commissary General at Umballa.

The farm comprises an area of about 60 square miles of grazing ground, a portion of which is canal irrigated, and a portion is given to *bunnsahs* &c., of the town of Hissar for their private use, and from which they realise a fair profit annually, by leasing the same to cultivators, and by the sale of fruit and vegetables. Why cannot this income be credited to Government? Surely the establishment kept up for the farm by Government is quite large enough to look after these portions, rather than that *bunneahs* should enjoy the profit thereon in preference to Government, or its rightful original owners, from whom it was taken for the purposes of the farm. I need hardly add that the whole of the land thus held by the *bunneahs* is canal irrigated, and as such considered very valuable in this part of the country.

The establishment maintained by Government for the farm, comprises a superintendent, with an office establishment, two European overseers, and variety of *chupraties*, *jemadars*, *daroogahs* and *palis* or cowherds &c., costing in round numbers say Rs. 25,600 a year.

Although there are 60 square miles of ground belonging to the farm, not a single acre is, I understand, under gram cultivation, and this latter has to be purchased in the local market, for the feed of about 9,000 head of cattle. It is true that the whole 9,000 may not be fed on gram; but say that if even half the number get one seer of gram per day, this will amount to 4,500 seers, or 112 maunds daily. The selling price of gram averages about 20 seers the rupee now-a-days. The daily cost to Government therefore, for gram alone, would be Rs. 224, or say Rs 80,600 per annum

Then again, an extra charge of *at least* Rs. 50 a day, or Rs. 18,000 per annum, is incurred for labourers, such as *bildars*, coolies, ploughs and carts for the portion of land under oat cultivation. Why cannot Government cattle be used for ploughing, irrigating and carting purposes? Why should carts be hired when a small outlay once for all, would save at least Rs. 50 per cent. of the Rs. 18,000? Then again, the collecting and stacking of hay after a good rainy season occupies a very prominent place in the cash expenditure of the farm. All these put together give us an annual expenditure of Rs. 1,23,600.

A word now in regard to the annual outturn. This consists of about two or three hundred bullocks for the Ordnance Department.

Supposing then that each bullock is valued at Rs. 100, this would amount to Rs. 30,000 per annum. Place this alongside the annual expenditure, Rs 1 23,600, we have an annual sum of Rs. 93 600, or a little under one fourth the land revenue of the Hissar district unnecessarily expended by Government, in spite of famine and war staring us in the face. This useless expenditure of Rs 93,600 annually can, in my humble opinion, be very easily averted. There are five cattle fairs held in the Hissar division every year, at each of which, if not superior, quite as good bullocks can be purchased for the Ordnance Department at an average cost, at the dearest of times, of Rs. 75 each, whereas as matters now stand, each bullock sent out of the Hissar farm every year costs the Government Rs 412 for which amount half a dozen quite as good, could be purchased without the trouble of correspondence, annual, quarterly and monthly returns, cash-books, ledgers, stock-books, dockets, and letters, which would effect a considerable saving of the cost of stationery, postage, feed of camels, overseers' horses, &c.

Two cattle fairs are held in Hissar, one in spring and the other in autumn every year; the same in Rohtak, and one fair in Sirsa. The Deputy Commissioner of these three districts could easily purchase all the cattle required by the Ordnance Department every year In fact this place would considerably enhance the income to the Municipalities of Hissar, Rohtak, and Sirsa, since the large demands of Government for bullocks would give breeders a great stimulus, increase competition, and draw sellers from far and wide, thereby increasing the Municipal fees.

The abolition of the farm would not only effect the saving I have alluded to above, but would also considerably enhance the land revenue of the Hissar district, since the whole of the 60 square miles, comprised in the farm, would necessarily revert of its original owners, who would be obliged to pay the land revenue thereon. There is no doubt there would be considerable litigation attending the renewal of the land to its original owners. The *bunneahs* who hold portion of the land, *under what authority I am unable to say*, would fight very hard against the legitimate owners, to retain it. I may note *en passant*, that there has been a case in the district where a *bunneah* cultivated some land belonging to the farm, and when the land was required by the farm, he actually instituted a law suit laying his claim to the land. I don't know the particulars of the case, but I believe he lost it.

The trouble, however, attending the abolition of the farm would be nothing in comparison with the saving effected, and the price realised from the disposal of the stock would come in very handy for any law expenses in which Government might be involved, the remainder being kept as a reserve for famine relief works, &c.

In conclusion I am of opinion that this large unnecessary expenditure of public money on the farm in these critical times is deserving of the serious attention of the Government.

12th April, 1878. OBSERVER.

MINERALOGY.

WE are sorry to hear that negociations with Messrs. Nicol & Co. of Bombay, for working the gold mines of the Wynaad have come to nought.

THE CEYLON PEARL BANKS.

THE *Ceylon Times* writes :—The recent inspection of the Pearl Banks at Aripo and elsewhere along the coast, has resulted in a very satisfactory manner, Captain Donnan having very good reason for believing that not only is the large deposit of oysters on the Cheval-paar undisturbed, and promising abundantly for 1880, but he anticipates a fishery of about three millions of oysters next year, *viz.* two millions on a small Aripo bank, and one million or thereabouts on a bank in the vicinity of Chilaw. The former fishing might be left until 1880 with advantage, but for the fact of the other extensive bank having to be fished in that year, and the two coming off at the same time might involve some risk of loss.

It may, however, be an open question whether it will not be of advantage in regard to the value of the pearls that a portion, at any rate, of the large bank be left over for fishing in 1881. The question of most profitable age for fishing pearl oysters has been long a moot point. At five years old the pearls found in oysters were admittedly larger, but it has always been regarded as a doubtful proceeding leaving the oysters on the bank for another year, on the score of their extreme liability to die off after the fourth year. During his recent examination, Captain Donnan, desirous of putting this question to the test, took his divers over a portion of the bank fished last year, where it was believed portions of the deposit still remained. The result proved that he was right, for the divers brought up seven hundred oyster from a comparatively small area and in very perfect condition. These were washed on shore, and the result was to shew that, as compared with the average weight of pearls from a similar number of oysters during last year's fishery, the actual gain has been 170 per cent.! No dead oysters were found amongst these seven hundred a proof that the belief in the liability to mortality after the fourth year is not well-founded. These being the facts it may be deemed desirable to act upon the knowledge, and allow, at any rate, a portion of the large bank intended to be fished in 1880 to stand over for the following year, in order more fully to test this theory.

The recently discoverd bed of young oysters lying in deep water to the westward of the other banks remains intact. This therefore bids fair to yield a large revenue in 1882, so that if the suggestion above made be acted upon, we may look for annual fisheries for the next four or five years.

The Planters' Gazette.

TEA.

RAIN fell all through the Darjeeling district last month. Most of the gardens to thenorth of Darjeeling have been especially benefited by the week's rain, as they had been suffering from drought. On several occasions the rain was very heavy and caused a good deal of "wash."

A CORRESPONDENT near Punkabaree writes: "Last night (7th ultimo) we had a fearful storm, accompanied by heavy rain. Within an hour I registered 3½ inches of rain. The wind and rain something terrific, and have done deal of damage here, cutting away the soil and leaving gaps scarcely passable by men. I have never witnessed such a storm since I have been up here. Tea plants have been washed completely out of the ground.—*Darjeeling News.*

TEA manufacturing is now general, both in Gurhwal and Kumaon, and the season promises well, barring the hail. The unsettled state of the Eastern Question is affecting the Central Asian Green Tea Trade, and black tea as a rule, seems to be the order of the day at present, says a correspondent. It is to be hoped that prices will rule higher this year, than they did in 1877. The writer adds: "The wheat and flour from the plains are now finding their way into our markets, and with the prospect of a good wheat crop in our hills, prices will rule comparatively low. The late rain was favourable for the rice. Grass, too is springing up plentifully for the cattle."

THERE was another heavy hailstorm in Kumaon on the 8th May, as bad as that of the 13th April. A correspondent of a contemporary gives a very gloomy account of the damage done. He writes: "On going round the tea plantation next morning, I found not only all the new shoots and buds (that had made their appearance since the hailstorm on the 13th ultimo) knocked off and lying under the plants, but small branches actually stripped, as if pulled off by the hand: this is the sort of loss that hill tea plantations have to suffer, which seldom occurs in Assam and Cachar. All hopes have again disappeared from our gaze for a good flush for at least another month, and longer for those plantations that have gone in for heavy pruning. I have just heard from an influential native that the barley and wheat crops are *totally lost*, and that the poor villagers are crying and beating their heads against the stones in grief."

THE tea season in Kumaon has opened prosperously, and the spring crop in April is fully equal to expectation. Paloo Mull of Umritsur who generally purchases one or two lakhs of pounds of green tea for the Central Asian market, has been here for the last month, taking delivery of last year's teas and purchasing the new crop. Prices show a slight improvement on last year for green teas. The price of black teas in Kumaon is generally maintained, as the small outturn from this province and the special delicacy of flavour which characterize its teas ensure ready customers at good prices. The demand for tea estates is increasing, and the principal bankers and commission agents are on the look-out for eligible properties. The excellent roads, picturesque scenery, and the attractions of the fine station of Ranee Khet are drawing attention to the merits of this district.

The climate is very healthy without any severe cold and the admirable gardens at Hawulbagh, Sitowlee, and Ranee Khet show that every description of English produce as well as the choicest tropical plants will flourish in perfection. Here we have side by side the cedar, walnut, and rhododendron indigenous to an elevation of 8,000 or 10,000 feet above the sea level, and the banana, orange, and loquat with hundreds of other denizens of our English gardens, or culled from the choicest stores of the Botanical Gardens of Calcutta or Saharunpore—*Delhi Gazette.*

THE tea sales for the current season are now being held in the large room of the Agri-Horticultural Society in the Metcalfe Hall. As an appropriate commencement of those sales, the Secretary of the Society brought to notice, among the many specimens in the museum, a small China caddy box containing specimens of Assam Pekoe, of the second quality, of the first consignment sent to the India House just forty years ago, namely in May 1838. These were, it appears, presented by the then Government Tea Committee to the Society. The consignment realized in London the fancy prices of from 24 to 34 shilling's per pound; and an offer was subsequently made to contract for 1,000 chests, as a commencement, at 2s. per pound. Such was the beginning, says the *Englishman,* of the present expensive tea industry of India. The Court of Directors, in there despatch, announcing the result of the sale of this small consignment, urge on the local Governments to encourage, in such manner as they may deem advisable, the cultivation of tea in Assam; and intimate their desire to receive suggestions with respect to furture plans, "particularly as to the best means of encouraging the cultivation of the tea with as little present loss to Government and as great prospective benefit to commerce as possible." How little could the most sanguine of the promoters of this industry, Wallich, Royle, Falconer and others, have conceived that in the short space of forty years, short in the history of a country, though a large unit in the life of an individual, from this small beginning of five hundred pounds, the export trade would have risen to forty millions, with a prospect of doubling that figure before the present century comes to a close.

THE Kangra Valley correspondent to the *Pioneer* writes :—

The 1st of May opened with a very severe hailstorm; there was a slight relapse on the 6th, and yesterday another bad fall did much harm to some of the up Valley gardens. For the last four days we have been having *pucca* monsoon weather, with the very unwelcome addition of a cold atmosphere—the thermometer ranging indoors from 60 to 70 degrees, while outside rain, hail, thunder, lightning and wind have made chaos worse confounded in the sky. As I write, a deluge of rain is pouring down, while the rumbling thunder is simply incessant. I have got into a bad way of continually harping upon the weather, but it is excusable inasmuch as a tea-planter like a mariner is the slave of the elements. In April and May last year there was an unusual quantity of rain, and the consequence was no good tea was made in the spring flush. This year there has been simply no leaf to make into tea, good, bad, or indifferent. Matters could not possibly look more gloomy, and managers are in despair. The outturn up to date is from 25 to 40 per cent. behind last season, and there is very little prospect of making any tea at all this month. I will not enlarge any more on the subject, but I am afraid the year will be a hard one for some to get through. The leaf may come in during the rains, and fill the factories chock full with dripping wet stuff, which one has neither the room, power, nor heart to make into good teas. As for *dividends* the word should be eradicated from conversation till 1879, unless it is an allusion to Dutch dividends. There has been almost a murrain of caterpillars during the last few weeks, which have played havoc in the vegetable gardens. In one plantation they took to disporting on the tea bushes, and the planter had a gang of boys bringing in half-a-basket full each time a day.

TEA SEASON, 1878-79.

(Balmer, Lawrie & Co's Tea Report.)

Calcutta, April 26.

WE have on the whole an encouraging report to give of the operations in the growing districts since our last issue. The usual hailstorms have occurred in various parts, and in some instances serious damage has been done, but this, so far as we can learn, has only happened to individual gardens here and there, and has not been general in any of the provinces.

ASSAM.—DEBROOGHUR—A hailstorm had visited this district, and the temperature was rather too cold in the early part of the fortnight, and this, though accompanied by rain, had tended to harden the leaf, and render it difficult to roll, besides causing the teas to be deficient in liquor; later on, the weather had become warmer and more favourable. Jaipur—Had experienced heavy showers of rain, and the temperature during the day had been all that could be desired. The cold at night was rather too great for the flushes. Rungagoora Road—Continuous rain, with occasional very heavy showers, and accompained by a high wind and hail, had done much damage to buildings and trees, but the injury to the tea plant was nominal; during the fortnight there were a few days of hot summer weather. The flush was not forward in any of the gardens, owing to the cold and the absence of sunshine. Seebsaugor—Had experienced excellent weather, sun by day and rain at night; few plantations had done more than some very light plucking; nearly six inches of rain were registered for March, and nearly five for the first ten days of this month, so there is not much fear of a lack of moisture for some time forward. A severe hailstorm had visited the locality and had done some harm. Nowgong—The first week was too dry and hot, and three days good rain during the latter week were very welcome. North Luckhimpore.—Very broken weather is reported from this district. The rainfall had been excessive, and as this continued generally, both night and day, there was great want of the genial sunshine so necessary for the production of leaf. Mungledye.— Heavy rain had fallen here from 6th to 15th instant, principally at night. The district is so far behind last year in out-turn.

CACHAR.—We regret to hear of the unwelcome advent of red spider blight in this province. Very heavy and incessant rain had fallen, the gauge in one instance having registered as high a fall as 11 inches in 10 days. Thunder storms had been of frequent occurrence, accompanied by high gales of wind and hail.

SYLHET—Was visited by very heavy squalls of wind and by a severe hailstorm, the latter doing a large amount of damage. The excessive drought during March had thrown many plantations back, but as the rainfall up to the first ten days of the current month was nearly 16 inches for the year, goodway should now be made.

DARJEELING.—Some favourable showers had rather improved matters, but the weather has again become very dry, and unfavourable for the manufacture of fine quality, the leaf being rather inferior, Progress for the latter part of this month cannot be equal to same time last year. The station was visited by a very severe hailstorm, which has done considerable harm to a number of gardens. In the Terai, the weather had been unusually hot and dry until the night of the 13th instant when rain fell in abundance; this should result in good succulent flushes. Manufacture was in full swing on most of the estates.

KUMAON.—Manufacturing was general over the whole of this division, but several concerns had suffered from hail. Copious rain fell from 10th to 14th instant, and sunshine was required.

CHITTAGONG—Had several good showers, accompanied by strong North-Westerly winds, in some gardens as much as 3 inches fell in one night. The temperature was very high.

CALCUTTA.—A sale was held yesterday at which about 1,000 chests were offered; of this quantity, about one-half were new season's teas, chiefly from the Darjeeling district, and these, as usual, were keenly competed for. It is said that the prices paid for the new crop were about 2 annas per lb. below the opening rates of last year.

Calcutta, May 10.

There are no news of special interest from the growing districts. In some parts plucking had hardly begun, and in this respect every season seems to be later than its predecessor. Formerly, April used to give the best return in the year, but now many planters hardly look for any leaf at all before May, while the best months are June and July.

ASSAM.—DEBROOGHUR—During the early part of the fortnight, considerable heat prevailed during the day-time, but during the night, the temperature was unusually cold. Some estates in this division suffered severely from hail, and will take some time to recover themselves; later news report greater warmth, and on the whole favourable weather, but rain was much wanted.

JAIPUR—Was visited by heavy showers of rain, with storms at night, the sun when shining, was excessively hot.

RANGAGORA-ROAD.—Hot sun, alternating with very heavy rain, a severe hailstorm passed over the district, inflicting nominal damage.

SEEBSAUGOR.—Very little tea had been made in this district up to latest advices, gardens being covered with banghy leaf; there was very little blight about. It was expected that this month would give a very fine result, as the young growth on the bushes in the neighbourhood was very vigorous.

NOWGONG.—The rain which fell here recently, has benefited the country very much.

NORTH LUCKIMPORE.—Here also the rainfall has been very abundant, and being accompanied by a warm moist atmosphere, the weather was very propitious for tea operations.

MUNGLEDYE.—The weather has been excessively hot in this neighbourhood, the thermometer registering as high as 94° in the shade; the rainfall has, however, been plentiful.

CACHAR—Has experienced very seasonable weather, and manufacturing is in full swing; more rain is required, however, and red spider blight seems to be shewing itself in various parts of the province.

DARJEELING.—Rain has been plentiful pretty well all over the district; it was much required, as some estates has been suffering from drought; red spider has attacked a number of gardens. The last week or ten days of April were not so favourable for manufacturing for quality, but so far as in May daily showers were experienced. The older hill gardens were generally behind last year in outturn to the end of April, and but little advance had been made up to latest dates.

KUMAON.—No rain had fallen since the date of our previous advices, and the weather generally has been too dry and cool for the flushes, the thermometer indicating a temperature of only 64° in the shade; even this is higher than obtained at the same time last year.

CALCUTTA.—During the fortnight, two small public sales have been held, at which nearly 2,000 chests were offered, most of the same consisting of new season's crop, at the former sale prices were not well sustained, the bulk of the teas consisting of undesirable quality. At the second sale, however, held on 8th instant, the inquiry was much improved; the few parcels of fine quality were eagerly sought after, and shewed an advance in price, while mediums retained their position. The improved demand was doubtless caused by the enormous deliveries to the London trade during April; these have been on a scale sufficient to swamp all the estimated crop and twenty per cent. besides.

LONDON.—Mail advices are dated 12th ultimo, at which date the market was in a very peculiar condition. There had been a general expectation, up to 4th ultimo, that an extra duty would be imposed upon tea, and large quantities had been entered through the Custom House, but since the date in question, the demand had slackened off, and prices were again irregular.

London Telegrams are :—

"April 26th—Offered 2,900 packages, sold 2,100. The market is firm for strong, weak for inferior.

"May 3rd—Offered 8,200 packages, sold 6,900. Market quiet, but steady."

Our private advices by wire, dated London 2nd instant, give the following interesting figures :—

Deliveries for April	4,200,000 lbs.
Stocks, 30th April	15,000,000 „

It seems pretty clear that the stocks have been overestimated by about 2,000,000lbs., in consequence of the London trade having estimated too great a weight per chest, and the visible supply is therefore much less than was supposed.

INDIAN *vs.* CHINA TEA.

AN animated controversy has lately been going on in *The Grocer*, on the subject of Indian and China teas. The discussion originated in a statement in *The Grocer* of 2nd March last, that Messrs. Sillars' "consider that the practice of not squeezing out the acrid matter from the leaves (which was originally introduced into India by Lieut-Col. Money) will prove a fatal bar to the consumption of Indian teas, unmixed with those of China in this country. The Chinese never waste anything, and they have done this for two thousand years. In Ball's 'Cultivation and Manufacture of Tea in China' it is stated: 'They (the leaves) are then roasted in an iron vessel, and afterwards rolled with the hands to express their juices. The roasting and rolling are repeated so long as any juices can be expressed from the leaves in the act of rolling." These remarks were submitted to an experienced Indian tea-planter, who comments upon them as follows :—"Messrs. Sillars' statement is wrong in fact; and I hope to show in the conclusion drawn from it that "the practice of not squeezing out the acrid matter from the leaves"—was not "introduced into India by Lieut-Col. Money. The truth is as follows :—When tea-planting and tea-manufacture were first introduced into India, no one knew anything about it, and consequently Chinese were imported to teach both. But in many, perhaps most, cases, the denizens of the Flowery Land who came to teach Britain's sons what they now know, and practise far better than any Chinese, were as ignorant on the subject of tea as their pupils—that is to say, though they were Chinese, they did not necessarily understand the manipulation of tea, any more than a man because he is English, must know how to brew beer. I suppose the first Chinese who presented themselves and said they understood tea were accepted. Anyhow, the fact is as I state—many of them knew nothing about it. Some did; or rather knew what was generally done in China; and tea manufacture was thus learnt in India partly from both the classes described. Some years ago both practices prevailed—that is, the juice was squeezed out at some gardens, not at others. In any case, the non-expression of the juice gave the teas with most body a strength which tea-planters soon found out themselves. The juice is now everywhere retained; and to this, in a great measure, is due the superiority of Indian teas. It is an error though, to say the juice is not expressed. Were the cells in the leaves not broken, and the fluid therein not set free, tea could not be made at all: but while the Chinese let the juice run to waste, in India it is taken up again into the mashed up leaves. There are other reasons why Indian teas are better and stronger than China teas, but those are irrelevant to the present point. Because a custom is immemorial, it does not follow it must be right. Though the Chinese have done as explained for "2,000 years," still the practice is wrong; and I can fancy the howl that would now be set up in Mincing-lane, if Indian tea-planters copied the Chinese in tea manufacture. Indian teas are valuable in one respect—their great strength—and, with all deference to Messrs. Sillar, I doubt this proving a "fatal bar to their consumption of unmixed, inasmuch as no one who has ever tried Indian teas will return to those of China."

The whole dispute is about this "acrid matter." It is asserted, on the one hand, that the Chinese manufacturers take care to express it in the process of rolling, and that the fact that they have done so from time immemorial, is proof that they must be right; that this "acrid matter" is retained in Indian teas, and not only gives them a pungent and disagreeable flavour, but is decidedly injurious to the health of the consumer. Indian tea drinkers may afford to smile at the statement, that "the acridity referred to by Mr. Sillar, is complained of by connoisseurs, though accepted by the rough artisan and Irish palate;" that the generality of Indian tea "cannot be so easily digested as China tea," and when used exclusively that it "is injurious to the health;" and at the experience of 'an old tea-dealer" who says that "instead of the refreshing and invigorating influence experienced from drinking fine China tea, I have found when drinking Indian tea, only an oppressive feeling—the very opposite." But when these opinions are constantly proclaimed in Messrs. Sillars' Tea Circular, and insisted upon in the columns of *The Grocer*, these assertions may have an appreciable effect upon the market for pure Indian teas. We have read through the controversy, in order to discover what this "acrid matter" really is, which is alleged to be "as poisonous as nicotine," and we have come to the conclusion that the most accurate definition is that given by an Indian tea-planter, who says that the alleged "acrid or tallowy "flavour of Indian teas, is nothing more than the absence of "an appreciative taste for a superior article." Such appears to be the simple truth. It is the superior strength of Indian tea which is really objected to, and the bitterness which the novice tastes in a powerful infusion of it, has been ascribed to the gummy matter which in reality softens the taste of the tea. In so far as the Indian teas are more pungent than China teas, the difference lies in the plant probably as much, as in the process of manufacture. On the subject of the expression of the juice during the rolling process, perhaps some of our planter friends might be able to give us information. Judging merely from the letters before us, we should say that Mr. Sillar is utterly mistaken in this matter. It is asserted, on the other side, that as regards the squeezing out of the juice, there is no difference between the process of manufacture in India and China. In both countries, the rolling and roasting process must be continued till the juice is expressed, because otherwise the tea will not continue rolled. But the fair teas in both countries, "are rolled in the pans, that is, on a surface, smooth and non-absorbent, so that in rolling, the leaf again licks up and retains the moisture which is pressed out."

A Neilgherry tea-planter of considerable experience writes further on this subject:—

"Mr. Sillar appears to object to Indian tea chiefly on account of the non-expression from the leaf during manufacture of what he terms the acrid juices, the retention of which renders Indian tea less easily digested and more insalubrious than China tea. Before entering on the method of manufacture of Indian teas, it will be as well to ascertain what are the constituent elements of the tea-leaf both Indian and China, and whether these component parts are in a physiological point of view, of such a character as to be deleterious to health. By an analysis of tea (*vide* the *Chemical News* October 24, 1873, in a paper by Mr. H. H. Allen, F.C.S.), very superior black congou, gave the following results:—Moisture, 9·2; insoluble matter, 58·7; gum, 10·5; tannin, 15·2. Hence the estimation of tannin was of the first importance. I have not the book before me, but I think if a reference be made to the *Popular Science Review*, No. 58, for 1876, page 103, an analysis of Assam tea will be found, and that the per centage of tannin in Indian teas far exceeds that of China. Now the question becomes—Does this excess of tannin render the Indian tea superior, or inferior, in a sanitary point, to China?

I am not aware that pure tea as a beverage has been proved from chemical analysis to have any ascertained elements as deleterious to health. A too frequent use of tea has been considered by medical men to act on the nervous system; but I question if there is extant a more harmless beverage if taken in excess, than tea, and if taken in excess it will have less ill effect than most beverages. I have myself drunk tea (Indian) in large quantities, and have never found any other effect therefrom than refreshment. I am therefore inclined to the opinion that the "acrid or tallowy flavour of Indian teas' is nothing more than the absence of an appreciative taste for a superior article. Now, with the above remarks, I will proceed to the manufacture of tea as carried on in India—the Neilgherries. It will be first necessary to state that all teas, green included, come from the same bush. Green tea is made by being at once fired without fermentation, whereas black is fired after fermentation has been completed, and one of the chief cares in the manufacture of black tea is to take the exact point of fermentation for firing, and that point is just before decomposition is complete, or the acid state arrived, or as it is called before the tea "sours."

Well, then, we will suppose black tea is about being made. The leaves are pulled over night, kept dry during night, and placed in the sun in the morning, and kept until the leaf has reached a high state of limpness or flabbiness, when it is rolled Now in the matter of the expression of the acrid juice, as Mr Sillar pleases to call it, (chiefly gluten), the quantity will depend in a great measure on the extent or the amount of dryness the leaf has been subject to before rolling, for it must be evident than if the leaf be very dry, the cellular tissue of the leas—in fact the leaves themselves—becomes more leathery and hardened, and therefore not so easily ruptured as in their green state, during the process of rolling; and different planters have different opinions on the questions of drying—*i.e*, the amount of drying before rolling—and whether the expression of the juice (gluten) does not tend to give the tea a more harsh (or what Mr. Sillar calls acrid) flavour than its retention. I am of opinion the retention of the gluten in the cells of the plant tends to give the tea a finer aroma and softer flavour; and I think this conclusion is but a logical one, for the retention of the gummy substance or gluten must give a softer taste to the tea than where the tannin alone is kept.

I am quite willing to admit that the drinkers of China tea do not at first appreciate Indian tea, but I have never without exception found my domestic servants do otherwise than after a time prefer the leaves of Indian tea, left in the teapot to fresh China tea. There is always one remedy ready at hand with Indian tea, and that is, if it is found too strong, it can be reduced by the application of more water to the standard of China, and then have more flavour than the China. It is generally believed that the Chinese do *not* roll their teas to the same degree as the Indian planters. The unrolled leaves in China tea show this, and moreover it is also stated the teas are sun-dried not fired. If such is the case, the juices must be retained in the China teas. The pungency of Indian teas over the Chinese arises from the difference in the plants, which is again changed by climatic influences. Teas of different districts have different flavours consequently."

The points in dispute are to be settled we hear, by submitting average samples of Indian and China teas to a competent annalyst for detailed analysis and report

TEA CHESTS FOR SAMPLES.

THE *Indian Tea Gazette*, in a recent number had an article on the above subject, accusing Calcutta Brokers of gross carelessness in opening and closing Tea chests for samples. The article has been replied to by a leading firm of Brokers in a circular letter as follows:—

An article which prepared in the *Indian Tea Gazette* of 2nd March last, entitled "Opening and Closing for Samples," having apparently led to some misapprehension regarding the treatment packages receive at the hands of the Brokers in Calcutta, we think it is only fair to all personally concerned in tea to make a few remarks on the subject.

The true facts are as follows:—On arrival of the chests, they are carefully placed in godowns and iron sheds, known to those well experienced in such work to be fit for the storage of tea. When the teas are wanted for sampling, they are laid out and opened by coopers trained to the work, and the leads are carefully cut just sufficiently to admit the hand of the inspector. The samples are than drawn by taking a small quantity, generally not exceeding one ounce from each chest; this is then mixed together, and divided among the brokers and a few well-known buying merchants (a two ounce packet to each), the residue being *returned* to the chests. *Immediately* afterwards, the leads are again *securely* soldered by experienced men, and the lids of the chests nailed down at once. No further opening occurs till after the sale, when, if buyers desire to see a fresh sample, two boxes only are opened. But in no case does any box remain open long enough for any deterioration to occur, the leads being always resoldered in a few minutes.

The chests are handled throughout with the greatest care, but some breakages, caused by the weakness or bad quality of the wood, cannot be avoided; these are always mended with fresh wood, new nails, or iron clamps, as may be required. New chests are given, if necessary, in the interests of both buyer and seller, and no boxes are ever allowed to leave the godowns unless considered in perfectly fit state for shipment.

With regard to the more serious part of the article in question, wherein it is insinuated that the value of tea is greatly depreciated by the local examination, we would point out that the tea market has now been established in Calcutta for nearly 15 years, and never before during the whole of that period, has any complaint of this kind been made. We consider the writer of the article had no grounds whatever for saying that any such depreciation takes place, and it is monstrous to assume that the sampling in Calcutta causes tea to lose its original character, or to become injured in value to the extent of *4d.* per pound. For the satisfaction of those concerned, however, we have placed the whole matter before two well-known London firms for a candid expression of their opinion, sending them copies of the paper containing the article; and we now annex their replies. We may add we have also made enquires of some of the largest buying houses here, and they fully endorse what is stated by the London Brokers.

Disappointment at the results of the past season was only to have been expected, and it is thought in some quarters that tea sent forward direct, realizes a higher price than when sold in Calcutta. How very illusory this opinion is, the following average prices paid in London in March and April last, for complete invoices of certain well-known brands, shipped on planters' account, will show. The marks for obvious reasons we suppress.

ASSAM GARDENS.

			s.	*d.*
194	Chests	... average	1	3¾
310	"	... "	0	9½
322	"	... "	1	3
391	"	... "	1	2¾
233	"	... "	0	11¼
228	"	... "	0	10¼
92	"	... "	1	1¼

CACHAR AND SYLHET.

			s.	*d.*
81	Chests	... average	1	1¼
90	"	... "	1	2¼
117	"	... "	1	1

DARJEELING.

			s.	*d.*
70	Chests	... average	1	2
177	"	... "	1	2¼
345	"	... "	1	2½
75	"	... "	0	10
91	"	... "	1	0¼

In calculating the averages, we have assumed that each chest contained an equal weight, which is near enough for all practical purposes.

We have gone thus fully into this matter in order to remove any mischievous effects which such statements as those referred to, evidently based only on a misunderstanding of the facts, may have caused.

WILLIAM MORAN & CO.,
Brokers.

(COPY.)

17, MINCING LANE,
London, 12th April 1878.

MESSRS. WILLIAM MORAN & Co.

DEAR SIRS—By last, mail we received your letter dated 15th ultimo, together with a copy of the *Indian Tea Gazette*, and have carefully perused the article to which you draw our attention. We are quite certain that Indian tea does not suffer to any appreciable extent by being examined in Calcutta, and this is proved by the fact that Calcutta-bought teas sell at precisely the same range of prices as those sent direct to London by the growers: any one can see this by referring to our sale catalogues. It is true that in some very exceptionable cases, packages are taken from the ships to the wharf or warehouse in cloths, the packages being in broken condition, but even in these instances the breakage has generally occurred on landing here, while the cargo is being removed. To rectify this, we would suggest that every Indian tea package should be properly dove-tailed together, as is now done by many gardens, because the weight of the ship's cargo alone is sufficient at times to cause a package not so dove-tailed to burst open at the sides. In conclusion (although of course if any exposure of the teas is allowed to take place in Calcutta, they would deteriorate in quality), as we do not see the teas before they arrive there, we cannot say whether or not in individual cases a deterioration has taken place, yet we can assert that, to the best of our belief, the article in question is founded on a misapprehension of facts, and is certainly a gross exaggeration.

LAYTON & Co.

(COPY.)

20, MINCING LANE,
London, E. C., 5th April 1878.

MESSRS. WILLIAM MORAN & Co.,
CALCUTTA.

DEAR SIRS—In reply to your letter of 8th March, directing our attention to an article in the *Indian Tea Gazette* of 2nd March last, entitled "Opening and Closing for Samples," we think the writer has taken a grossly exaggerated view of the harm done to packages by opening them in Calcutta. In our experience, extending over many years, we have never had occasion to attribute the slightest injury to tea in consequence of the local examination. We consider, therefore, the idea propounded by the writer of the article in the *Indian Tea Gazette*, that such examination causes tea to lose its pungency and strength, and to become dull, flat, common etc, to be a purely fallacious one.

LLOYD & CHESSHIRE.

JAPANESE TEAS.

JAPAN tea, which is so much favoured in America, we tasted in Paris at the house of the *Daily News* correspondent. The infusion was copper-coloured, exceedingly strong, and tasted as if somewhat over-roasted. The Japanese, anxious to compete with China and India, despatched a Commission to gather information and report. The report has been received and is about to be acted on, but the *Japan Times* predicts the failure of any attempts by the native cultivators, to complete the process of firing and packing up-country. It is denied that they possess either the necessary capital or character for honesty. But we had better quote a portion of the article.

In a partial report on the tea season of 1877-78, which appeared in the last number but one of this Review, we made some comments upon the careless curing, up-country, of the natural leaf; and also on the anxiety manifested by the natives to produce both Japan Black Teas, and uncoloured Japans, packed and fired so as to be suitable for direct shipment by foreign exporters. These are important subjects which deserve further consideration.

The first—the growing inferiority of the natural leaf, noticed as it is brought down season after season, no doubt arises from the steady decline in price enforced by Yokohama native dealers, who,—finding that foreign buyers will not continue to take inferior quality, year after year without reducing their offers,—are obliged for their own protection, to adopt the same course in their operations up-country. Another cause for the evil is that the shrubs are evidently too closely plucked and thus is impoverished each succeeding year's crop. The excess gathered produces another bad result—glut of the market: thus, if they would spare a large proportion of common third crop pickings, they would alike benefit the tea plant up-country and improve their own market in Yokohama.

Their attempt to rival either China or India, in the production of Black teas, we regret to have to condemn as chimerical in the extreme. The Japanese had established a high reputation with consumers in the United States, for their own uncoloured leaf,—had in fact, driven a large proportion of both Greens and Oolongs out of consumption; and with only a little moderation in production, and devotion of their attention to improving, picking and preparation, there is no doubt that uncoloured Japans would have maintained their character and high quotations in America. But no:—patience, perserverance, moderation are virtues which do not characterize the Japanese peasant cultivator of either tea or silk; and the fables of the Dog and his shadow, and of the Goose with the golden eggs, are addressed to him in vain. Not content with having largely increased their export, and found a most remunerative market, within a very limited number of years, they grasp at more, and risk losing all. A desire for novelty, for change, for experiment, is also another failing of the national character; and all these defects are reflected in a notification, recently issued by the Naimusho, urging the preparation of Black tea, which we quote:—

> "Tea is one of the principal productions of Japan, and is a source of considerable wealth to the country. Our method of preparation does not, however, suit the foreign markets, and we must accordingly introduce the same process as that which is adopted in China. At present it is only in America that our tea finds a market, and thus although the production of tea has greatly extended in our country, the price has fallen so low that our increased labours have been productive of no proportionate gain. Commissioners were therefore some time ago despatched to India and China, in order to learn the best way of manufacturing black tea. It has been found that the method followed in India is superior to that in China, and Indian teas have now obtained a good reputation in Western markets. Some experiments on the manufacture of black leaf have been made in Kochi Ken, and the results have been found to be adapted [illegible] foreign requirements. Now should we at first send an inferior artic[illegible] foreign markets, our reputation for its manufacture would be rui[illegible] the trade result in ultimate loss. We shall therefore issue instructions as to the best method of preparing black tea (literally red tea) in order that they may be strictly followed.

Of course, no one would blame a nation or its government for endeavouring to stimulate industries of all descriptions; but why not improve, first, to the highest attainable point the production of Japan's own natural leaf,—before rushing into competition with other countries, where soil, climate, and the nature of their variety of tea shrub favour the production of Black tea? And at what a risk!—that of absolutely destroying a trade which has grown rapidly and is susceptible of great increase, but which has but one market, which they are doing their very utmost to lose. Is it possible that the Minister for Public Industry is as blind as the tea dealer or the peasant, and fails to see the danger which impends over the Japan tea trade? That danger is—that, if uncoloured Japan teas continue much longer to depreciate in quality, American consumers may take to drinking Black teas. And if they do, those Black teas will assuredly not be of Japanese production.

Returning to the attempts to fire and pack tea up-country; we have further to advise our native friends, in opposition to their ideas, that a large outlay per *picul* for tea leads, for a better style of boxes and packing, and other expenses will be necessitated; which as the tea growers are not, generally, men of such means as the Chinese tea farmers, or the English tea companies in Assam, must be provided for them. Further must be taken into consideration the risk of transport to the port of foreign shipment and the heavy loss which would be incurred did a parcel arrive in bad order and require repacking. In China, these risks are greatly lessened by the facilities given by the canals for safe and rapid tr[illegible] by water carriage; facilities which this country only enjoys in a very i[illegible]or degree.

Government interference with trade is always bad, [illegible] a rule. But Government notifications seems to be employed in Japan [illegible] giving advice as well as orders. And in giving advice in such a form Government might confer a benefit instead of doing harm. If, instead of stimulating an attempt to make Black tea out of a leaf which will not make it, would impress on producers the great necessity of giving more attention to the growing, picking, and first preparation of the leaf up-country; secondly, if it would reprobate the practice of mixing together the leaf of various provinces, at least, if not of districts; and thirdly, if it would give encouragement and assistance to teamen to get the crop down rapidly, so as to give it into the hands of foreign buyers, fresh, and thus enable them to complete the process of firing whilst the leaf is in a state most favourable for the process, and likely to produce the most satisfactory results.—*Japan Times.*

COFFEE.

RECENT advices about coffee in the Brazil State that the fearful drought which has in many districts entirely destroyed the ground crops, has so affected the coffee business, that berries gathered from the extremities of the branches are found to be valueless. That is the effect on the present crop. On the next, the effect will be to diminish quantity and seriously to injure quality. Growers of fine plantation in Ceylon, therefore, will be subjected to so much the less competition; and, if no unforeseen events take place, prices for high quality coffees are likely to remain good.

THE cultivation of Liberian coffee in the Galle district is actively pursued; we hear that near Udugama, about 25 miles from Galle, some 9,000 acres have been purchased for Liberian coffee. About half of this land belonged to Baron Delmar, and the other half to Messrs. D. C. A. and D. J. A. Gunewardena. Mr. T. F. Dobree is one of the purchasers, and is now on the land opening nurseries and selecting the most favourable spots to commence operations upon. The timber on this land is valuable, and will be removed before burning the jungle. Near Amblangodde, about 5 miles from the Colombo road, Mr. A. R. Wiggen has purchased a block of land, and is planting some quantity of it. The value of land suitable for Liberian coffee is rising rapidly, and native land-owners who were glad to sell a year ago at Rs. 5 to 7 per acre, are now asking Rs. 20.

THE coffee enterprise in Coorg, in spite of the gloomy predictions uttered with respect to it, appears to be struggling on manfully. The season 1876-77 was a bad one, the crops being generally smaller than they were expected to be. About 50 per cent. of the berries are reported to have dropped off during the monsoon, owing to the unseasonable and scanty rains in April and May. In some localities a large proportion of the berries were light or malformed. These misfortunes do not appear, however, to have frightened away private enterprise, for we read in the Coorg Report, that "there was an increase in coffee plantations. One hundred applications were referred to the Forest Department; of these 65 were disposed of in addition to 45 pending from last year, making a total of 105 inspections." Liberian coffee has proved a failure in Coorg. None of the seeds distributed by Government to the planters germinated, and the few plants grown do not appear to have thriven so well as the indigenous plants.

COMMISSION ON COFFEE DISEASES.

AT a meeting of one of the District Associations in Ceylon, a few weeks ago, it was proposed by Mr. Ballardie, seconded by Mr. Kerr, and carried with one dissentient:—"That Government be requested to grant a Commission to inquire into the causes of the various coffee diseases, and to suggest remedies for their removal."

Mr. Ballardie in bringing forward his motion said, it had been a matter of the greatest surprise to him considering the vastness of the loss, that the subject had not long ere this occupied the attention of every planting body in the country, and that Government had not of its own accord for the public good, without any asking on the part of the planters, granted this Commission. There had been no country holding the position Ceylon does, that had not at once on the advent of such a serious disease affecting the staple product of the country, brought the most scientific knowledge attainable to bear upon it, and had not moreover offered large rewards for any discovery which could ameliorate it, and in the majority of cases with admirable results, witness in England the wheat commission, in Ireland that on potatoes, in France, Australia and nearly every petty German State on the vine, and the one more recently which had sat in America on the Colorado beetle. The expenditure on our estates since the advent of leaf disease has gone up about 50 per cent. while the product has gone down 30 per cent. As far as we have figures to judge from, the return up till 1868 was over 5 cwts. an acre; since that date, taking the figures from Ferguson's Directory, and in all cases taking two years to secure a proper average, it is found that the export in 1868-69 gave 5·14 cwts. per acre, in 1870-71 5·13. Towards the end of 1871 leaf disease began to show seriously, witness the result:—

In 1872-73 the export fell to 4·06 an acre.
" 1874-75 " " 4·61 "
" 1876-77 " " 3·49 "

or in 6 successive years crops show a decrease of 1·65 on the whole shipment of the Island, and there is no doubt averaging this crop, just shipped and that now estimated, a further decline will be shewn. The crop shipped in 1877 was 860,911 cwts. where, had we had the old averages we ought to have exported 1,200,531 cwts. or, taking the value of coffee at £4 per cwt., this represents a loss to the coffee planters alone of £1,400,000. The loss to the general revenue must be proportionate. Government may tell us to cultivate more highly, and thus get rid of the disease. The cultivation we have gone in for, but we cannot get rid of a disease by feeding it, and the more we manure our coffee, the stronger, the healthier, the more succulent the leaf becomes, the more basis there is for the disease to feed on. From the railway returns of the quantities of manure carried, we find, while in 1868-69, ·66 of a ton was the average per acre for coffee in full bearing, ·25 in 1876-77 gives much inferior results, and we must admit that the manufacture of estate manures has largely increased between these dates, and we would probably be nearer the truth in saying ·50 of a ton was about the quantity now applied. The following figures, supplied by a Colombo firm, of four estates, scattered over the country, show the difference between cost of cultivation and returns, better than any argument:

Cost per acre.

1868-69	Rs. 94	Rs. 98	Rs. 80	Rs. 90
1876-77	141	112	135	117·50

Returns per acre.

1868-69	7·05	7·58	5 45	6·50
1876-77	4·45	3 20	3·44	4 22

With an increase of the bearing acreage within these years of 50,000 acres, there is an actual decrease in the shipment of crop of 74,792 cwts. It is generally said a Commission is a simple way of shelving a difficulty, but in this case it would not be so, as no planter would be foolhardy enough, not to take advantage of everything possible offered to get rid of this curse. If crops decline in the succeeding six years as they have declined in the preceding six, the average outturn in Ceylon will be 1·76 cwts. per acre. There are other diseases on which the commission would be advantageously employed, grub, bug, fungus. No matter what this commission cost, be it £10,000, be it £20,000, taking it at the lowest light, a Government ought to look at it commercially. The return would in less than a year repay the outlay. We ought to have the most scientific men procurable, such men as Mr Cook and the Rev. Mr. Berkeley and Sir Joseph Hooker, and for local knowledge and assistance Dr. Thwaites and Mr. Morris, and there is no practical information which any planter possesses but would be gladly placed at their disposal. Mr. Ballardie quoted Sir William Gregory's speech in support of the necessity of Government granting the commission and concluded by stating, that he brought the motion up at this meeting that it might be well ventilated through the district, and copies of this resolution be sent to all District Associations, that, when the matter was brought up at the Kandy meeting by some more eloquent planter, he might have at his back the support of every planter in Ceylon.

Mr. Elphinstone thought that Mr. Ballardie ought to be thanked for bringing the matter forward, and supported the motion. Mr. Heelis could not agree to a committee, as in his opinion leaf disease and coffee would die together.

CAPE COAST CASTLE COFFEE.

WRITES the *Ceylon Times*.—The stupidity of the Liberians in their recent legislation becomes the more striking when it is taken into account that the limited spot of West African territory called Liberia possesses no natural monopoly of what, for convenience sake, has been called Liberian coffee. Our readers may recollect that in January 1877, we published information supplementary to that afforded by Liberian negroes, such supplementary information being furnished by the Rev. Mr. Freeman, a Wesleyan missionary labouring on the Gold Coast, who described his trees as flourishing on the banks of the river Sekwin, about eight miles west of James Fort, Accra. Accra is a name familiar in connection with the Ashantee campaign, and looking at an atlas, we see it is situated almost exactly on the longitude of Greenwich, latitude 5°30' north, or 1° nearer the equator than is Colombo. The Ivory Coast intervenes between Liberia and the Gold Coast. Mr. Freeman wrote:—"I only know of one kind of Liberian coffee, which I obtained some years back from Cape Palmas,"—Cape Palmas being the southern limit of Liberia. Mr. Freeman, like others, no doubt, in Sierra Leone on the one side, as on the Gold Coast on the other, obtained supplies of seed from the cultivated farms of Liberia, but there can be little doubt, that the gigantic coffee is indigenous over a much wider region of the west coast of Africa than Liberia. Mr. D. Morris, in the note with which he has favoured us for the forthcoming work on Liberian coffee, states that this species "belongs to Liberia, to Golungo Alto, and to Sierra Leone, though perhaps only as a cultivated plant in the latter place." Be that as it may, the belief is that Cape Coast has a coffee of its own not only equal but superior to the Liberian. We were informed some time ago that plants had been grown in the Peradeniya Gardens from Cape Coast seed, and that the plants were in every respect superior to the Liberian. We see, also, that in Jamaica they are going in for the Cape

Coast coffee as something superior to Liberian. We are promised further information on the subject, but we cannot delay attracting our readers' attention to the fact that either as indigenous or cultivated, the gigantic coffee exists in the British Colonies of Cape Coast Castle and Sierra Leone, from both of which places, we should think, supplies of seed could be obtained. The foolish action of the Liberian Legislature has increased not merely the value of all plants in Ceylon and other foreign countries, but that of plantations like the Rev. Mr. Freeman's and those of others. There can be little doubt that one of the effects of the Liberian prohibition will be to promote the smuggling of coffee into the British Colonies, or on board of passing steamers. In any case we do not see why Messrs. Irvine and other merchants should not, after a time, be able to resume shipments to Ceylon. While writing, one of our tin boxes of Liberian coffee per *Eldorado* has been opened, and the parchment beans are hot from fermention, which has rotted the vast majority. We cannot hope for success with more than 10 per cent. of the consignment. Our readers will recollect that we directed that the parchment beans, well ripened and well dried, should be packed in earth with its natural damp—beans and earth being hermetically closed in tin boxes, and the tin boxes put in wooden cases. Tea lead being used instead of tin, this mode has succeeded admirably with tea seed from Assam. But the coffee has been a full month in the boxes longer than it ought to be, and an experienced coffee planter who was present at the opening agrees with us, that a large proportion of the beans were neither well ripened nor thoroughly dried. After all, if 10 per cent. of the beans become plants, and if we pay five *cents* for each plant produced, in addition to the £30 for seed, we shall not complain. It is just possible that some of the other nine boxes may have been packed with cherries, and may give different results. If so, those results will be made public.

THE SETTING OF COFFEE BLOSSOM BY IRRIGATION.

MR. WEED writes on the above subject in the *South of India Observer* as follows:—

In your paper last week was a paragraph noticing a coffee branch full of fruit, which had been brought on entirely by irrigation. I was glad to see this; irrigation, as a means of improving coffee, being almost altogether overlooked. Where water in sufficient quantity is at hand, irrigation affords an easy and exceedingly cheap means of securing some portion of the crop, even in the driest years. There has been, however, a most unaccountable prejudice in the minds of many planters against irrigation: why it is difficult to conceive, as I have never found among the objectors, any who had given the system a fair trial. One planter went so far as to assure me that irrigation continued for three years would kill any coffee that ever was planted; I could not learn though that he had witnessed this result himself.

Irrigation, like many other things, is good or otherwise according to the time and seasons of its employment.

> "All things by season season'd are
> To their right praise and due perfection."

All depends, as far as my experience goes, on the water being applied at the right time. As all planters know to their cost, the blossoming showers are very capricious: irrigation, as applied to coffee, should as much as possible take the place of the wanting showers. When blossom is in spike and wanting rain to bring it out, *then* is the time to irrigate. When blossom has been brought out by a slight shower, and is in danger of not setting for want of more rain, *then* again is the time to irrigate, and these two special times are the only times that I have found irrigation of benefit. If water be applied to the tree before it has begun to recover from its last crop, its first effort will be to throw leaf, and the sap then flows to the leaves instead of to the fruit buds, and the consequence is lots of foliage and little crop. Continuous watering, forces nothing but leaf, as may be seen by the side of any water course through a coffee field. To water a tree before it has put out its buds, is but a forcing of nature, and what path she will take is beyond our ken,—it may be either that of luxuriance or of fruitfulness. We want no such hap-hazard business; our endeavour should be to follow and assist nature, and not to force her.

When the fruit buds are formed and are waiting for rain only to expand them, there can be no error in applying water, as we are only assisting nature in the direction she desires to take. Again, when the bloom is over, and rain is required to start the young berries, irrigation only takes the place of a shower at the right time. Generally, one watering of a field will be enough, as in three cases out of four, there will be either showers to open the blossom, or to set it, but in case there are neither, there must be two waterings. Irrigation properly carried out is safe and sure, and in saying this I do not speak at random, but from an experience of five years, during which the same patch of coffee has been watered every season, and has every season given a good crop. Not only have the trees good crops, but they have improved in every way, the primaries are longer and stronger, and every year carry more wood; they stand out conspicuously at all times of the year as greener and healthier looking trees than those around them. Irrigation is certainly worth a trial by those who have water at hand, and land not so steep as to cause a wash.

LIBERIAN COFFEE.

THE following extracts are from the valuable notes, which Mr. D. Morris of Peradeniya has contributed to Mr. Ferguson's forthcoming volum on the new coffee:—

Taking the description given in a former paragraph as an enumeration of the characters of a typical tree of *C. liberica*, it is necessary to remark that there are varieties within certain limits which require to be noticed. Among the trees cultivated in the Botanical Gardens at Peradeniya there are some which have characters so distinct as to be easily recognised even by a casual observer. For instance, one variety is distinguished by having rather smaller concave leaves by developing a more vigorous growth of primaries and secondaries, and by constantly producing globose berries with very large flower scars: these are among the largest trees and bear the best crops. Another variety appears to have flatter and narrower leaves, the berries are distinctly ellipsoidal and the seeds are very characteristically pointed at both ends. Other trees are marked by less distinguishing characters, but in trees where the number of petals vary between 6 and 9, it is to be expected that variation would take place in other organs. The instances given above are the most distinct varieties which have come under notice. It may be added that plants raised from these varieties retain their characters and are easily recognised. If there are several well-marked varieties of *C. liberica*, it would be well to propagate and distribute those only which exhibit a vigorous and healthy growth of wood and produce the largest crops. The variation in the number of petals is not constant in the same tree, but the petals are never fewer than six, or more than nine. The berries when ripe are of a dull red colour, not so bright as those of *C. Arabica*. Hiern in his description, probably from dried specimens, speaks of the berries as black; at Peradeniya they have never become black, indeed they are not always completely red. If *C. liberica* is the original of Cape Coast coffee, we shall have to add another variety to those indicated above. Dr. Roberts, who has had many opportunities for observing the trees on the West Coast of Africa, considers *C. liberica* and Cape Coast coffee to be distinct. There are three trees received as Cape Coast coffee now in the Botanic Gardens about 18 months old. They are more robust in habit even than *C. liberica*, their leaves are thick and leathery and more than 15 inches in length. No trace whatever of leaf disease has appeared upon them, though young plants of *C. liberica*, under similar conditions have suffered more or less from it. When these plants have flowered and produced berries it will be easier to notice any further points of difference which exist between them and typical plants of *C. liberica*. With regard to liability to attack from leaf disease, it appears that plants of Mocha coffee suffer more severely from it than any others, so severely indeed, as to kill a large number of very fine young plants in a few weeks. The ordinary coffee comes next followed by *C. liberica*, and with Cape Coast coffee, so far as our present experience goes, at the head of the list.

It is well known that young plants of *C. liberica* suffer severely in nurseries from attacks of the *Hemileia*, but if the soil is good, and a little liquid manure is applied they soon recover, and after 18 months or two years, they seem to be strong enough to withstand the disease and become healthy and productive trees.

LIBERIAN COFFEE BERRIES AND SEEDS.

As may be supposed from the habit and size of the trees, the berries of Liberian coffee are larger and finer than those of the ordinary coffee. The average length of the berry of *C. Arabica* seldom exceeds ½ in., while the average length of the berry of *C. liberica* is nearly 1 in. The pulp or outer covering of the Liberian coffee berries is thick, rather fibrous, and more or less fleshy, but never succulent as in the ordinary coffee. The shell just under the pulp, the indurated endocarp, is hard and brittle, seldom looks clean, and is generally of a dull brown colour. The "silver skin" which comes next is strong and tough, dipping into the deep furrow on the face of the seed and carefully investing the substance of the coffee bean. In descriptive notes on Liberian coffee berries and seeds, it may not be out of place to describe their character and structure with some detail, and place before those interested in the subject, facts which may prove of value in dealing with the propagation and distribution of this promising plant. The seeds of Liberian coffee enclosed within their investing coat are generally two in number: when one seed, as is sometimes the case, becomes abortive, the other seed receiving all the nourishment of the berry, becomes large and rounded, and is termed a "pea bean." When the pulp is removed, the seed covered by the hard brittle shell, the indurated endocarp, is technically termed a "pyrene": there are therefore two "pyrenes" in each perfect berry. The "pyrene" is convex on the back, flat, with a narrow, usually deep longitudinal furrow on the face. If the hard shell investing the pyrene, the "parchment," be removed, we expose what is generally called "rice coffee." Carefully examined the structures which make up the rice coffee or *seeds*, are resolved into a membranous testa or coat of the seed, the "silver skin," a horny folded mass termed the albumen, and embedded in the substances of the latter near its base, is a small body called the embryo, the miniature Liberian coffee tree not more than one-third inch in length. Botanists classify the different parts of a fruit like the coffee berry as follows:—(1) the outer skin of the berry is termed the *epicarp*; (2) the pulpy mass between the skin and the parchment is the *mesocarp*; (3) the indurated shell called the "parchment" is botanically the *endocarp*; (4) the "silver skin" which comes next to the parchment is the *testa* or integument of the seed; (5) the mass of the coffee bean under the "silver skin" is the *albumen*; (6) and contained in the albumen, embedded near its base is the minute *embryo*. The first, second, and third structures in this series belong to the *fruit*, whereas the others, *viz.*, the testa, the albumen, and the embryo, are essentially parts of the *seed*. The uses of the various structures which surround the minute embryo are to protect it from injury and at the same time to supply it with suitable nourishment till such time as it is able to take care of itself. Most people are familiar with the grey pearly "silver skin" which forms the outer covering or testa of the coffee bean. It envelops every part of the albumen, follows its foldings and dips into the deep furrow on the face. By its tough, leathery nature it acts as an effectual protection to the delicate structures within. Before the bean is roasted the parchment and silver skin are removed, and then we have left the horny folded albumen making up the bulk of the bean. It is this albumen, roasted and ground, which supplies the coffee of household use. In the economy of plant life the albumen is intended for a very different purpose: it is a patrimony which the young embryo is supposed to utilize and adapt for the purposes of its growth and development. In fact it is a supply of food specially and wisely adapted to promote its first impulses of life and energy. When examined under the microscope the albumen consists of a number of cells, with walls more or less thick, forming a store house of nourishment in the form of starchy compounds, volatile oil and other vegetable products. If in a fresh mature bean we cut rather obliquely towards its base we shall come upon a small cylindrical body completely invested by the tissue of the albumen. It is about one-third the length of the bean and looks like a small peg with a round head. This is the embryo of the future plant and apparently now consists of only two parts. The narrow pointed part directed towards the base of the bean is the radicle. This, in the process of germination will develop into the tap root, while the round head, called by botanists the *plumule*, will be found on examination to consist of two very minute fleshy leaves—the cotyledonary or seed leaves of the young plant. Between these minute leaves is a process called the *punctum vegetationis*, or growing point of the ascending axis destined in process of time to give rise to all the various structures of stem, branches, leaves, flowers and fruit.

PROPAGATION BY SEEDS.

For the raising of Liberian coffee from seeds, the first requisite is a supply of well ripened seeds, as fresh as possible. From the description of the various structures contained in a coffee seed it will be seen how delicate and sensitive these structures are. If the albumen be injured by damp or fermentation, or if it be exposed to the hardening and desiccating influences of a dry atmosphere, it will be rendered quite unfit as a food supply for the young seedling, and it is owing to these circumstances that imported seeds so often fail to produce healthy plants. In the case of well-ripened seeds, under favourable conditions, 96 to 98 per cent will germinate and at least 94 per cent, will develop into fine trees. As in other seeds it is necessary in order to produce germination that they receive the proper amount of moisture, heat and air. The moisture required should be supplied by moderate but uniform watering, night and morning. Excess of water will have an injurious effect upon the young plants, and render them weak and sickly. The best soil for raising seeds is a mixture of loam and leaf mould, or earth produced by rotten leaves, sifted and mixed with an equal volume of sand: the sand keeps the loam from adhering together when watered, and allows excess of water to drain off, while the loam retains as much water in the cavities of the soil as is required for the purposes of germination. Jungle soil, well sifted and mixed with an equal proportion of sand, generally forms an excellent soil for young plants. The seeds may be sown in deep boxes or in beds formed in the open air. In any case a good depth of soil is necessary, for even in a very young seedling the tap-roots are extremely long, and they require an abundant supply of good rich soil to keep up their growth.

The plants should be grown in partial shade or covered by thatched hurdles or "cadjans"; care should be taken not to cover them up too much; when established the protection should be very gradually removed according as the plants indicate their ability to bear the effects of light and sunshine. For transplanting purposes bamboo pots, baskets, or cowdung pots, may be used. Where easily obtained the bamboo pots are strongly recommended; they afford every protection for the tap-roots, and at the same time supply them with a good depth of soil. The cowdung pots require more care in making, and on young estates the material may not easily be obtained; but, where it is possible to make them they are superior to anything else for transplanting purposes. Once the young plant is established in the cowdung pot it is safe, for when buried in the soil, the material of the pot becomes softened by moisture, and is easily penetrated by the roots, thus forming a protection for the roots when handled, and ultimately a valuable manure to the plant.

Seeds of Liberian coffee appear to take a longer time to germinate than the ordinary coffee. Seeds sown on the 2nd January appeared above ground and were 2½ inches high on the 1st February. They remained apparently *in statu quo* for about a month, but by the end of March the two bright seed leaves were fully developed. Two months longer are required to thoroughly establish them, so that, under ordinary circumstances, Liberian coffee plants require about five or six months before they can be safely transplanted; and, when transplanted, too much care cannot be taken in handling the tender young rootlets and preserving them from injury.

In germinating it will be noticed that at first there is only a short pale green stalk, surmounted by the rounded oval form of the parchment bean. The structures of the coffee seed noticed in the last section have now become greatly altered. Under the stimulating effects of heat and moisture, the embryo has pushed forth its radicle and penetrating the soil, has begun its life's work of absorption; on the other hand the ascending axis of the embryo has grown upward, and drawing its first nourishment from the albumen enclosed in the parchment and testa, appears as a short stalk with a globose head. It should be here noticed that in order to nourish the young plant all the starchy compounds contained in the albumen have become changed during germination into sugar—a process analogous to what takes place with regard to starchy compounds in the animal economy. During the apparently stationary period, noticed above, the cotyledonary or seed leaves are growing larger and larger within the parchment case. When they have exhausted their food supply, the parchment covering, as well as the silver skin, fall off, and then the two fresh bright-green seed leaves, being well supplied with moisture by the roots, begin their work of elaborating the juices and supplying the plant with its proper supply of food.

GENERAL REMARKS.

The plants of Liberian coffee now in the Botanic Gardens consist of several groups planted at different periods since 1873. The largest trees, now nearly ten feet high, were sent from Kew in Wardian cases in March 1874: they were transferred into bamboo pots a few months afterwards. Out of 24 plants received, four were so severely attacked by leaf disease, that they succumbed; the others suffered more or less, but ultimately recovered. Many of the latter, however, show that they were weakened by the disease, for they are short of primaries and lose their leaves more rapidly than the healthy ones. Mr. Ferdinandus, the foreman of the Gardens, who has given considerable attention to this coffee, is a strong advocate for partial shade for young trees at this elevation. He believes that in the low-country near the sea, the air, though warmer, is full of moisture, and the progress made by the trees at Henaratgoda strengthens him in the opinion that the Liberian coffee requires a warm, moist and stimulating climate. During the warm weather on the hills, the air is evidently too dry for young plants, unless they are partly shaded: mulching with dead leaves, jak shavings, or even saw-dust, is found very beneficial in dry weather. If the plants have a deep rich soil and can send down their long tap roots into it, they may dispense with shade and be all the better for the larger supply of light and air. The trees mentioned above came into blossom when 18 months old, but none of it set. In March 1876, another and a larger blossom was produced, which set abundantly. The berries were ripe in the following December, and from the seeds a large number of plants were raised. This was the only blossom produced in 1876. In the following year 1877, they blossomed early in March, and a good crop of fruit was produced by the close of the year. At the end of April in the same year, and at intervals varying from two to three months, the trees were in partial blossom, and they have ever since borne berries in different stages of growth. The principal flowering time, however, is March, and the main crop of fruit is ripe by the middle or end of December.

In 1875 a parcel of 30 seeds, packed in damp moss was received from Mr. Bull; these germinated and grew up into healthy plants. The attacks of leaf disease were but slight, and the plants, in partial shade, are now doing well and nearly 5 feet high. A leaf of one of these plants measures 18 inches in extreme length and 8 inches at the widest part. Instead of the wedge-shaped base narrowing as it approaches the petiole (stalk) of the leaf, the base is rounded and almost resembles the full oval outline of the extremity of the leaf. The variations in the outline of the leaves, in the number of petals, in the size and shape of the berry and in the area of the flower scar, are points which may well be noticed; for, if they are associated with a more robust habit, with a greater immunity from leaf disease, and also with a large production of crop, it is evident that such varieties are deserving of great attention, and as special varieties would well repay careful and systematic culture. Mr. Ferdinandus, who has successfully raised several thousands of plants of this coffee, prefers trees with small concave leaves, globose berries and large flower scars; these are certainly the finest trees at Peradeniya and they bear the best crops. Attention having been drawn to these variations in Liberian coffee, it is quite possible that others may be noticed. As the cultivation extends, we shall no doubt be able to gather more accurate information respecting them and learn whether any special variety is adapted for special areas of cultivation, or for higher and lower elevations.

A group of plants received from Mr. Bull in 1876, were soon afterwards planted out in fresh jungle soil. Slightly shaded at first, they quickly established themselves, were topped at 6 feet, and now (March 1878) they have shewn their first blossom, which has abundantly set. One or two trees placed in rather thick shade have shewn that under such conditions they become drawn up and attenuated, and their first primaries are 8½ feet from the ground. It is quite certain that anything beyond a very partial shade is not suitable for this coffee. As soon as the young trees have well established themselves in rich deep soil, they can bear, provided the air is moist, full exposure to the sun.

In the third year the trees may be expected to produce a good crop with a succession of blossom every two or three months, according as the weather is favourable. The trees begin to throw out their secondaries in the third year, but apparently not so rapidly and regularly as the common coffee. It will be noticed that in branching, the Liberian coffee has an erect tree like habit, and its primaries do not possess that horizontal and drooping habit which is so characteristic of *C. Arabica*. When rather large trees of Liberian coffee are attacked by leaf disease, the leaves show perforations scattered here and there over their surface; the fungus seems to be confined to isolated areas, and the leaves being so large, instead of causing them to fall off, a round hole is made through them as if eaten by a caterpillar. Thus the greater part of the leaf-area is left intact and it is enabled in spite of leaf disease to discharge its functions as an essential part in the economy of the plant. It can hardly be expected that a plant of this kind can be entirely free, from the attacks of the many parasites which affect vegetable life in Ceylon. One tree of Liberian coffee has been attacked by borer, and the leaves of a small plant have been entirely destroyed by the caterpillar of the pearl moth, but cases of this nature, so far, are too isolated and possibly too accidental to allow any general conclusions to be drawn from them. That the Liberian coffee in the adult state is strong enough to resist attacks of leaf disease, and that it is well suited for cultivation in the extensive districts of the low country, are alone sufficient to render its cultivation in Ceylon, one of the most promising undertakings in the Island.

The nature of the Liberian Legislation is thus indicated in the *British Trade Journal*:

The statement has gone forth that a Bill has been presented to the House of Representatives in Liberia, proposing an export duty of 1*s*. on every coffee berry (for seed), and 1*s*. on every plant sent out of the country. This Bill, should it pass, will amount to a prohibition of the now famous Liberian coffee plant.

CINCHONA.

THE Secretary of State has, we hear acknowledged from the Madras Government, the receipt of 577 bales of cinchona bark per S.S. *Malwa*. The bark realised a net sum of £19,965 10*s*. in the home markets. The renowed crown bark which sold for 15*s*. 8*d*. in 1877 realised in some cases 11*s*. 10*d*. in 1878; whilst the the mossed crown sold for 11*s*. 7*d*. in 1877; and 8*s*. 1*d*. in 1878; branch crown which brought 5*s*. 7*d*. in 1877, sold generally for 4*s*. 1 *d*. in 1878.

A GENTLEMAN in Ceylon writes that he cut down some cinchona trees the yield from which was as follows:—From 196 *succirubras* 2,000lbs. of bark from 11. *Officinalis* 56lbs. of bark. The trees from which the above yield was obtained were over 12 years old and grew among coffee. The *succirubra* gave an average of 10lbs. per tree and the *officinalis* 5lbs per tree. At 3*s*. a pound for the *succirubra* and 5*s* a pound for the *officinalis* the return for the 207 trees would be something like £314, or at the rate of £1,570 per acre. This would be a highly satisfactory result, even if the planter had to wait 12 years for such a return. The system of cropping adopted is in the case of course complete rooting out.

GOVERNMENT NEILGHERRY BARK SALES.

PRIVATE information gives the following particulars of a sale of Neilgherry cinchona bark, which took place in London on the 12th March last :—

	Bales		s.	d.		s.	d.
Mossed Crown ...	... 47		7	11	to	8	2
P.							
Unmossed Crown	... 57		6	8			
Renewed Crown ...	... 16		10	0			
(*Neddiwuttum.*)							
Unmossed Yellow	... 5	cases	12	7			
N.							
Unmossed Crown	... 91		7	4	to	7	5
Mossed Crown ...	... 93		9	2	to	9	8
Renewed Crown...	... 48		11	8	to	11	10
(*Dodabetta.*)							
Natural Crown ...	... 99		6	4	to	6	5
D. N. C.							
Mossed ...	... 65		7	6	to	7	7
D. M. C.							
Renewed Crown...	... 15		9	6			
D. R. C.							
Branch Crown ...	... 36		4	1			
D. B. C.							

We should be glad if Government will favour us with particulars as to the difference between *mossed* and *renewed* back.

• HORTICULTURE IN COORG.

(*From the Coorg Administration Report.*)

Cinchona.—The Government cinchona garden, for the cultivation which a greater outlay was required than was deemed justifiable, changed hands during the year. The property was sold at cost price to Mr. Richter who carries on the cultivation at his own expense. A small quantity of bark of the *h. succirubra* sent Home by him to the London market, sold at rates varying from 2*s.* to 3*s.* 5*d.*, but the market was just then exceptionally high. The stools of the coppiced trees, though the stems were carefully sawn off in October, have not thrown out suckers, but died down to the roots, owing apparently to the long drought. For the same reason, seeds put down at the end of the monsoon failed, but a hopeful seed nursery is now springing up. It appears that the present high rates of the bark, have awakened a new interest in the cultivation of cinchona, which hitherto has not found much favor in Coorg, though the *succirubra* thrives well and is useful even as a shade tree for coffee

Liberian Coffee.—Of the seed distributed by Government to several Croog planters none has germinated, though the experiment was tried under various and most favorable conditions.

The packing of the seed seems to have been deficient to preserve the tender vitality of the bean, which should be preserved in a mixture of charcoal powder and camphor kept in an air-tight vessel or tin. The few plants grown in Coorg do not seem to thrive as well as the indigenous plants.

Cinnamon.—C . all the seeds received by Mr. Richter, he succeeded in rearing one plant of which he has since made several cuttings to grow.

Cocoa.—This plant cannot yet be said to have taken kindly to Coorg soil and climate ; the few plants in existence throw out in the beginning of the monsoon new shoots in place of the old decayed ones, but the plant has no healthy vitality. A new experiment will be made in the cinchona garden with some healthy plants ready for transplanting.

Caroba—There is a tree about seven years old on the Pollay-betta estate in the Bamboo District, which grows remarkably well , it is 15 feet high and very spreading in the crown, but up to this time it has not produced any flowers The plant thrives also in Mercara.

The Grape Vine.—Perfectly ripe and sweet grapes have been grown on the Central School premises in the open on a vine, which adapted itself the seasons of Mercara, flowered in November 1876 and produced the ripe fruit in February 1877.

The Vanilla grown in the same locality, but under cover, flowered in March 1877, and one pod is now developing towards maturity.

Experiments with the seed of the *Pinus Excelsa* and *P. Longifolia*, received last July from the Conservator of Forests in Mysore and Coorg, have been thus far successful ; some of the plants are 18 inches high and require transplanting.

The Eucalyptus Globulus, in its rapid but slender growth is unable to cope, unsupported, with the high monsoon wind and succumbs. An attempt has been made to grow it in a close t[illegible], each plant supported by a cinchona tree, and a favorable result is expected.

The Cedrela Toona or white cedar, in Kanarese "Negamara," which grows wild in Coorg, is looked upon not only as a hand-some avenue tree, but also as a good shade tree for coffee, and on several estates seed nurseries of the tree have been made.

The Poinciana regia.—This magnificent avenue tree; though introduced more than ten years ago and growing to stately dimensions in South Coorg, shewed flowers for the first time in this hot season, evidently owing to the long drought.

The Moreton Bay Chestnut ("Castanospermum Australe") and the *Grevillea robusta*, lately introduced from the Bangalore Government Gardens, do very well in Mercara.

Firewood plantation in Mercara.—Though little or no care is bestowed upon it, the trees (*Bellandi* white cedar) are growing satisfactorily.

Avenue Trees.—Those who watched from the beginning this truly beneficient undertaking of shading our great trunk roads with wide spreading avenue trees, are much gratified by the steady growth of the well selected trees, chiefly jack (*Artocarpus Integrifolia*), the varieties of Ficus and Champaca or Sampige.

AGRI-HORTICULTURAL SOCIETY OF MADRAS.

AT a Meeting of the Agri-Horticultural Society of Madras, held at the Gardens on Wednesday, 3rd April, 1878, Major-General Raikes, C.B. in the chair, the Honorary Secretary intimated that the following contributions had been made to the Gardens, and a vote of thanks was passed to the donors. 1. Records of the Geological Survey of India, Vol. X., Part 4, 1877, from Government, Public Department. 2. Journal of the Agricultural and Horticultural Society of India, Vol. V., Part 3, New Series, from the Society. 3. Trade Lists of Flower and other Seeds from E. G. Henderson and Son, Sutton and Son, Mangin of 6, Rue de Louvre, Paris, and Vilmorin Andrieux & Cie. 4. Index Seminum Ann 1877 Collectorum, from Hortus Ræ. Universitatis Romanæ. 5. Annual Report of the Royal Botanical Garden, Calcutta, for the year 1876-77, and Fifteenth Annual Report of the Government Cinchona Plantations in British Sikkim, by George King, Esq., M.B., F.L S., Superintendent of the Royal Botanical Garden, Calcutta, and of Cinchona Cultivation in Bengal from the Author. 6. Seed of Musa superba from George King, Esq., M.B., F.L.S. 7. Seed of Corypha Australis from L. A. Bernays, Esq., Vice-President, Queensland Acclimatisation Society, Brisbane. 8 Seed of Erythrina India, Cratægus sp., and Browallia elata, from J. Steavenson, Esq. A letter was read from the Superintendent Government Farms, in reply to the Honorary Secretary's letter of 1st idem, forwarding copy of a letter that he recently addressed to the Board of Revenue regarding the so-called Brahmie cotton, and stating that no seed of this cotton plant is at present available at the Sydapet Experimental Farm. A letter was also read from L. A. Bernays, Esq., Vice-President Queensland Acclimatisation Society, dated Brisbane, 29th January 1878, advising the despatch by post of seed of their handsome palm "Corypha Australis," packed in charcoal, in tin hermetically sealed which being quite fresh, ought, judging from fromer experience, to reach us in good order ; asking for palm seeds, particularly of "Phœnix rupicola," in exchange, which he suggests, if our experience of his method of packing be favourable, should be sent in the same manner; and stating that the drought still prevails nearly throughout Queensland, that cattle and sheep are dying by thousands, that serious as the consequences already are, the anticipations are far worse of the effects of a grassless winter on the weakened stock ; and that a universal downpour in the next few weeks could alone save them from losses which would seriously affect for years the condition of more than one important industry. Major Herbert Wood, R E., writes as follows to the Secretary, "I beg to acknowledge the receipt of your letter dated 1st March, together with copy of Dr. Scheffer's letter of 13th December last, and a parcel of the seed of *Hevea elastica.* I shall make a point of sending the Agri-Horticultural Society a full report of the result of the experiments, which they have been so good as to afford me the possibility of entering upon."

FROM the Report of the Committee of this Society for last year we observe :—

GARDENS.—Several new or rare specimens have been added to the Society's horticultural collection, amongst which are *Ceratonia siligua. Pithecolobium saman, Cassia aurata*, a number of palms received from, Dr. King, Royal Botanical Garden, Calcutta, several new and handsome crotons and other plants received from the Queensland Acclimatisation Society, several plants of *Musa ravenala*, raised from seed gathered from one of the specimens in the Society's Garden, and *Swietenia mahagoni*, raised from seed.

LIBERIAN COFFEE.—In February it was resolved that enquiry should be made as to the progress of the Liberian or West African coffee plants distributed by the Society in 1874, and some interesting information on the subject was received from J. W. Burnett, Esq., of Calicut, and A. Jamieson, Esq., of the Government Botanical Gardens, Ootacamund. Mr. Jamieson reported that the plants received by him were growing famously in the Government Garden at Burliar. Mr. Burnett favoured the Committee with a very full report on the six plants sent to the Wynaad, which is printed in the Proceedings of 4th April. The result appears to be that the plant is not so well suited for the Wynaad as for lower and hotter districts. In June Sir Joseph Hooker, having had the necessary funds placed at his disposal by the India Office, forwarded to the Society for distribution five cases containing 250 plants of Liberian coffee, which arrived in good condition, with the exception of about a dozen. They were distributed to various subscribers in the Presidency.

GRASSES, FODDER PLANTS &c.—The Prickly Comfrey (*Symphytum asperrimum*) has been tried with moderate success, and the Committee have been unable to join in the enthusiasm with which the idea of its introduction was received by many. It was advertised in 1830 (nearly fifty years ago) by Mr. Grant, nurseryman at Lewisham as an agreeable, fast growing, and nutritious food for both cattle and horses, and it is difficult to understand why, if it possesses all the good qualities attributed to it, it has not become more common than it is now. In June last a small bag containing eight different kinds of grass seeds, stated to be summer grasses, and the best pasture grasses of the Darling Downs, one of the best grazing districts in Queensland, was presented to the Society by Walter Hill, Esq., of the Botanic Garden, Brisbane. Packets of each of the kinds were sent to the Superintendent, Government Farms, with a request that he would experimentalise as to their usefulness, and a small quantity was sent to Sir T. Madava Row. The remainder were tried in the Society's Garden, and five of the kinds grew luxuriantly in pots, three of them having failed to germinate.

ADVERTISEMENTS.

NOTICE.

MR. F. A. COHEN is appointed Manager of the *Statesman and Friend of India* Office, and has assumed charge this day.

All communications concerning the general business of the Office, Advertisements, and Subscriptions to the daily *Statesman and Friend of India*, weekly *Friend of India and Statesman*, and *Indian Agriculturist*, should be addressed to Mr. Cohen.

All Remittances on account of the Office should be made, as heretofore, to Messrs. Nicholls and Co., Financial Agents.

R. KNIGHT,
Managing Proprietor.

Calcutta, 18th April 1878.

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- Messrs. Moran & Co. and the *Tea Gazette.*
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A MONTHLY

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VOL. III.] CALCUTTA: MONDAY, 1st JULY, 1878. [No. 7.

NOTICE.

Mr. F. A. Cohen is appointed Manager of the STATESMAN AND FRIEND OF INDIA *Office, and has assumed charge this day.*

All communications concerning the general business of the Office, Advertisements, and Subscriptions to the daily STATESMAN AND FRIEND OF INDIA, weekly FRIEND OF INDIA AND STATESMAN *and* INDIAN AGRICULTURIST, *should be addressed to Mr. Cohen.*

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R. KNIGHT,
Managing Proprietor.

Calcutta, 18th April 1878.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb. 1876.

R. KNIGHT.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

ROTTING OF COFFEE TREES.

TO THE EDITOR.

SIR,—Can you or any of your readers tell me, from what my coffee trees are dying? Suddenly a full-grown healthy looking tree begins to droop. Its leaves turn yellow, and drop off; in ten days the tree is dead. When pulled up, the roots are rotten and smell fusty. I can find no grubs or anything. They don't go out in patches, but everywhere, I know the borer well, it's not that.

PENTON HUNTER BLAIR.

PERMEAD.
June 4th

BONE MANURE.

SIR,—Can you kindly inform me as to the easiest and most practical method of converting bones into manure in India?

It would be an appreciable benefit to the country to instruct such classes of cultivators as would not object to use it; how such bones could be cheaply utilised as manure.

W. COLDSTREAM,
Deputy Commissioner, Hashiarpur.

NOTE.—Break up the bones into small pieces with a hammer or other similar instrument, mix them with an equal weight of ashes, and about one-sixth of fresh slacked lime; put into a shallow pit or trough, keep the mass continually moist, and turn it over now and then. If the bones are well broken and the lime fresh, a fortnight will suffice to reduce the bones to powder. The result is a perfect fertiliser, but in this state too powerful for immediate use, and requires to be mixed with mould, or better still, burnt earth; it is a better fertiliser than guano; and it has been said that rust is prevented by the use of this manure.—ED., *I. A.*

EXPERIMENTAL FARMS.

SIR,—I am glad that you strike so powerfully in the *Agriculturist* against that absurd notion, ever gaining place in the minds of our officials, that experimental farms should pay. No one at home ever asks whether the £300,000 spent annually by the Kensington Department for Science and Art Education *pays*; nor whether the large expenditure for keeping up the British Museum and National Picture Gallery pays; whether the £22,000 annually spent by the Kew Garden authorities returns a profit; whether the quarter of a million pounds spent annually by the Agricultural Society on shows is a profitable *investment.* Yet the paltry sum granted annually for agricultural improvement in India is by many *officials* considered to be wasted because *they* cannot see a direct money return. There is a return and, I hesitate not to say, a most handsome one, but it is an indirect return and cannot be shewn in a balance-sheet, but it is quite as real as that which is received by the expenditure at home in keeping up the S. Kensington Department, the Kew Gardens, the Museum, Picture Galleries, &c. We with difficulty get £4,000 a year for all branches of our work for the whole presidency, the rent-roll of which is 4½ millions of pounds sterling. Many Irish landlords spend 25 per cent. of their rent in developing their estates.

10th June 1878. S.

ASHES AS MANURE.

SIR,—I perused in one of the back numbers of the *Indian Agriculturist*, some remarks about the comparative value of ash and cow-house manure, in which the writer states that the effect of the ash in benefiting crops is greater by 8 or 900 per cent., than that of the cow-house manure.

I have not yet had an opportunity for giving ash manure a fair trial—owing, I believe, to the difficulty of collecting a sufficient quantity of it for spreading over a large area of land. I would feel much obliged if any of your agricultural chemists would enlighten me on this important point.

If your correspondent means that, if ash and cow-house manure of equal weight be spread over a certain area of land, then the productive powers of the ash will be greater than that of the cow-house manure by 8 or 900 per cent, and of this—there can be little doubt—the difficulty lies in collecting sufficient vegetable matter for producing the needful quantity of ash, so as to answer all intents and purposes, and to do so effectually a large expense will be needed, which cow-house manure is exempt from.

I desire to view this subject in the light of an agriculturist, or rather an indigo planter, who depends chiefly on the indigo refuse (*seet*) for manure—he is further obliged to remove the *seet*, while scarcely rotted and decomposed, and spread it over his fields and the difficulty experienced in causing it to amalgamate with the soil is great and troublesome, under such circumstances, is it better for planters to spread the fresh *seet* over the fields in small heaps and when dry, to reduce it into ashes and scatter it over the lands? To bring the matter nearer home, I have just now a large heap of *seet* behind my vats left from last year, and which is in a crumbling and pulverised condition and readily mixible with the soil, should I then spread this old *seet* as it is over my field, or would it be better to reduce the whole into ashes, and scatter the same over the fields?

On reducing some of the last years *seet* into ashes, I found that the ash just weighed about one-fifth, of the *seet* burnt during the experiment, besides which the bulk of the ash was greatly altered and reduced, showing the same difference as between the contents of a cart and wheelbarrow.

A. QHRISTIAN.

Puterghat, 6th June 1878.

NOTE.—If carriage to the field is expensive, we would recommend the *seet* to be converted into ashes, and spread on the field just before ploughing. Results very satisfactory in clayey and loamy soils. For light, sandy soils, we would prefer using the *seet* itself. The stems being very woody, should always be reduced to ashes. Indigo *seet* a powerful nitrogenous manure, benefitting nearly all crops, seems, however not to be suitable as a manure for indigo itself. The indigo plant absorbing nearly all its nitrogen from the atmospheric air, may explain that, in this case, the ashes would be the shape in which to utilise the manurial properties of the *seet*.—ED., *I. A.*

THE GOVERNMENT *vs.* AGRICULTURE.

SIR,—It is surprising how ignorant the Government is regarding the real requirements of the soil and the people. It fosters works which rob the soil of its proper nutriment, and then it is surprised that famine desiccates the land. For instance, see the incalculable amount of harm done to this province by the introduction of the out-still system. Since April, petty distilleries have been erected at all the local bazaars in the province; and the consequence is, the price of *mahwa* has risen from 55 seers to 25 seers per rupee; *and immense quantities of arhar and cotton plant stalks are purchased for these works.* I have not the figures before me to show how many of these distilleries have sprung up since April, but they can be counted by thousands I have no doubt. And the Government is probably congratulating itself at the masterly stroke of its financiers, which adds a few thousands to our revenue at the expense of raising the price of the best available cattle-food in the country from 55 to 25 seers per rupee; and causing the waste of millions of maunds of plant-food as fuel. In fact all the *mahwa* fruit and vegetable fibre, which are used in these distilleries, *are lost to the soil.*

The *mahwa* fruit besides being an excellent fattening agent for cattle, is very nutritious to man, and is largely consumed by the lower classes. It played an important part during the scarcity of 1874, in helping to stave off famine from the ryots' doors.

When will the Government of India open its eyes to the fact that the soil requires to be nourished and fed instead of being robbed and starved? Nothing more plainly shews the culpable ignorance of our financiers in all matters connected with the welfare of the masses, and the agriculture of the land, than this last system which has been introduced in the Excise department.

I write from no spirit of contrariness, but from a desire to see true reforms introduced. Being a quiet observer of the affairs of the country, I too often see how painfully Government strains itself over a gnat, whilst in four years it swallowed a camel in the shape of 16 million pounds in famine expenditure.

AGRICULTURIST.

BAMBOO AS PAPER STOCK.

SIR,—I have just received your journal of the 1st April, and from your editorial note appended at foot of my letter of the 27th February, I perceive you still retain some predelection for "so-called" *grasses.* Now this botanical family of grasses is a very extensive one, and my remarks thereon must be taken *cum grano*, that is to say, I admit that grasses will or may be converted into paper, but must, in that case be used locally, as the quality of the paper that can be made therefrom, although it may be sufficient for native requirements, would not suit European markets, neither would the "stock" producible from such grasses (with freight and other charges added to manufacturing cost) admit of its being laid down in this country at a price to pay, nor would such stock compare in quality with the "stock" now produced from Esparto grass, the present cheapest "raw hard material," we English paper-makers use.

I have had numerous sample parcels of "grasses" sent me through Dr. King, also by Government through other channels, and in no one single instance has any sample I have as yet received either in quality, or in cost, of manipulation (putting freight on one side) been equal to Esparto.

I wish to be clearly understood; that some of the grasses will make paper, and of a quality sufficing for "present" Indian requirements I admit; but that it *will "pay"* to import them "raw," or the stock made therefrom, into the English or European market, I deny.

Bamboo (a "grass") is the exception, but only if cut "green," *as a grass*, that is in its herbaceous stage, later it becomes "wood", a tree in fact, imbued with silica and other endurating compounds, its "fibre" harsh and brittle, and presenting the same difficulty, and cost in treating it, as ordinary woody fibre; in the herbaceous or vegetable stage, however, while the sap is flowing, before the silicious and other indurating compounds are deposited and woody fibre formed, its treatment is exceedingly simple: cut down at this stage, the sap is evaporated, the stems losing 70 to 75 per cent. in weight, but as bamboo, it is now admitted, will, by cultivation under irrigation produce fully if not more than 40 tons per acre, these 40 tons will yield 10 tons, which reduced to "Paper Stock" losing in the process 40 per cent., will yield 60 per cent., or 6 tons per acre; a far greater yield than any other fibre producing plant, known to botanists; as an illustration, flax yields 6 to 6½ cwt., hemp 7 cwts. and jute 6 to 10 cwts. per acre, all these plants requiring mechanical manipulation in order to produce or separate the ultimate fibres from the stalk or extraneous matter.

Bamboo is peculiarly singular in this respect, that (excepting the small portion of short woody matter in the knot) the stem consists entirely of fibre, or to make myself more clear, assuming the stem of the bamboo to be cut, and then dried placing it in the same position as any other fibrous stem from which the ultimate fibre has to be produced—it will yield 60 per cent., whereas in comparison flax, hemp, jute, and similar plants in like condition, will not yield more than from 8 to 12 per cent.

With all exogenous fibres, such as those just named, after drying the stems or stalks, a process of retting, followed by breaking, scutching and heckling or analogous process, must take place, whereas with bamboo, these are not required: and with endogenous plants such as plantain, aloes, pine-apple, &c. &c., still more elaborate processes are necessary to produce merchantable fibre.

I base my strong predeliction for bamboo upon the fact that its production (once a plantation is started under irrigation) is continuous, or nearly so. No cultivation being required; collection only at the proper stage of growth of the stem; its treatment is simple in the extreme, no mechanical appliances needed, and the quality of the resulting "fibrous stock" meeting all paper-making requirements, such stock, moreover, for the foregoing reasons producible at a cost which must obviously be less than that for any other fibrous material: with this very great advantage, that the quantity and easy and rapid growth of the raw plant, "bamboo," in tropical countries, and notably in India, is practically speaking illimitable.

I may add that the consumption of Esparto Grass amounts now in England alone to upwards of 200,000 tons yearly, with a demand for paper also increasing in the like ratio, there is a wide field open for a material like bamboo, which will command a ready market because superior in quality and producible at a cheaper rate.

Claxheugh Sunderland,
6th May 1878.

THOS. ROUTLEDGE.

INDIAN AGRICULTURE.

SIR,—Can we teach the ryots to farm better than they do? This seems to be one of the questions of the day, and one which is often mooted in the *Indian Agriculturist*. The ryots of the Deccan are not prejudiced against the use of any implement or putting on their fields any commodity by which their crops would be improved and their pockets filled, but it seems to us that in this country things get broken and out of repair sooner than in England: it may be through want of reasoning power on the part of the people, but the climate with its extremes of heat and moisture, with its drying east winds and the number of destructive insects and animals, have also much to say to it. Deep ploughing, scientific manuring, the cultivation of grain crops which give a speedy return, the growth of fodder crops for the cattle during the hot weather, abstaining from burning cattle dung, are all suggestions that have been made for the benefit of the ryot lately. Now how can he comply with these? He cannot use the English plough without learning how to work it, without being sure that the village smith and village carpenter could mend it when broken. Allowed that the plough was given to him, and that he had begun to work with it, we must allow that it would be of little use to him, unless he was sure of its remaining in working order, and for this the time is not yet ripe. The same argument applies to other articles of improved machinery. With regard to prepared manures, chemical or other, a great deal depends upon employing them at the right time and in the best condition in not letting their strength evaporate through drought and over exposure, or deteriorate through excessive moisture. Again they must be cheap and always obtainable when the ryot requires them As yet the ryot has not the knowledge of the qualities of those manures, nor the facility of obtaining them The *Agriculturist* rightly points out that the municipalities are the agency through which this knowledge may be disseminated and this assistance given to their neighbours. What are the powers of the municipalities? Have they land? Have they money at their disposal? If so, we can of course appeal to them, urge them to make enquiries as to what similar bodies, notably the Coimbatore municipality, do. Why should not accounts of the proceedings of these institutions be weekly collected, printed and published in the vernaculars, distributed gratis to our municipalities, and read at their weekly meetings? A motive for meeting will then be created knowledge will be disseminated, topics for conversation and discussion will be started, and those meetings will be looked forward to with interest Any one who has tried to get these meetings held regularly, can bear me out in the assertion, that it is very difficult to awaken and keep up a regular interest in anything I would also have a system of exhibitions—grain and vegetable shows to begin with—instituted by the municipalities, at which small money prizes and certificates might be given to the ryots of the neighbourhood from the Municipality shows, it would be an easy step to taluka, collectorate, division and presidency exhibitions

My experience of district life, more especially during this last season, has shown me that the ryots do not burn the cowdung cakes if they can get any other fuel, and here officers who have had charge of relief kitchens can bear me out. Everywhere I see collected and stored up in heaps, the sweepings of the cattle sheds and what of litter and manure is found, where the animals have been tied up for the night The dung of the cattle which go out to graze on the common lands, is common property and is collected by the poorer classes, who if they were deprived of this, would often have no fuel at all Besides the cakes which they make of it, meet with a ready sale in large villages and towns The ryot takes proper care of his cattle manure, and returns to his field as far as he can, what he takes from it In the Ahmednuggur Collectorate this year, may be seen round many wells, patches of lucerne grass which is regularly cut and given to the bullocks. The ryots tell me that for the last five years they have grown it, that finding the usual supply of forage short they made enquiries, many of them went to the head-quarter station to find out how they could get assistance, and seeing this grass grown regularly there, they bought some seed and tried it. They give as much as Rs. 4 per seer for it and find it pays well, so much so that in places I have found them, willing to sell it to me regularly. They scout the idea of any *sahib* having introduced it in their villages, no, they made enquiries for themselves and found the advantage of so doing. Some even talked of having got seed from Bombay and from Guzerat: anyhow they know how to grow fodder crops for their cattle during the hot weather. Jowari and Indian corn are of course grown as well. This latter being one which yields the speediest return of corn, is largely grown (as far as the supply of water in the wells admit, that is to say) for the food of the ryot's family, now that everything is so dear. It is grown this year certainly in preference to vegetables for the sake of the fodder for the bullocks, and is in fact almost the only vegetable we can now obtain; not much of it is brought into the weekly bazaar, but a few cobs are generally obtainable, and I must say for my own part that I think there are not many more palatable indigenous additions to one's table than the young tender grains boiled in milk. Here and there I see a patch of sweet potatoes, which also is a crop grown by the ryot almost exclusively for his own use, and which seldom finds its way into the market. I hold therefore that the ryot, according to his abilities, makes the best use of the means at his disposal, but seeing that Messrs. Sutton only ask 1s. per lb. for lucerne grass seed, it is to be hoped that he may be able to obtain it at a cheaper rate than he at present pays.—Yours, &c.

G. COUSSMAKER.

Ahmednuggur, May 27.

The Indian Agriculturist.

CALCUTTA, JULY 1, 1878.

AGRICULTURE IN BEHAR.

IN reviewing Mr. Reid's pamphlet, noticed by us in our May issue, the *Englishman* remarks that the district would be in rebellion, before half the measures which Mr. Reid advocates for the improvement of the agricultural masses were introduced. Mr. Reid replies to the *Englishman* as follows:—

"You have a mistaken idea of the character of the Behar ryot, if you imagine that a few simple rules laid down for his guidance, and the improvement of his land, will drive him to rebellion. If, in your opinion, it is Utopian to endeavour to lay down the nucleus of a sound system of agriculture for Behar, where none existed before, then all I can say is, that as yet you do not fully realise the situation of affairs in this province. A few more seasons of distress and famine are probably required to lay matters before you in a plain light I maintain that, practically, the British Government has not done anything to improve the condition of the cultivator. Railways have been made to carry away the produce of the soil after it has passed from the hands of the cultivator to the *mahajun*. High level canals, containing the purest river water in the world, which is totally unfit for irrigational purposes, unless it is supplemented with manure, have been tried with disastrous results to the soil of the North-Western Provinces. And even our rent laws have failed to improve the condition of the masses.

A sound system of agriculture is what is really wanted, the introduction of which should be the aim and object of our Government So far nothing in this way has been done, and the frequent famines and never ceasing scarcity in the land prove how the soil has been neglected. Law, and so called security of person and property, have hitherto been washed down the ryot's throat with doses of pure snow-fed canal water but it is very evident that neither he nor his land flourish under this treatment, as the cry emanating from them both is, for "vittles"

"The ryot's method of cultivation in every single respect is rotten to the core, and diametrically opposed to the principles of good farming the production of such enormous quantities of saltpetre alone proves this statement"

"The herding together of the cultivators in large villages should be discouraged as much as possible, if only for the benefit of their health and the first step towards attaining this object will be made by marking the cattle and registering their numbers. The ryots will then take to living more in their fields along with their cattle, away from the unhealthy influences of the filthy villages; and, as a natural consequence, the prepared cow-dung will be stacked on the field instead of in the villages. It is no hardship to the ryot to have these rules inserted in his *pottah*."

"Is there anything Utopian in the proposal that the ryot should receive a suitable *pottah* for his holding, and trustworthy receipts for rent paid? Besides, as every district is now made self-supporting, the latter mentioned arrangement could be turned to most beneficial account. In this way, if the Government issue a separate kind of one-anna receipt stamp for house and land rent only, and insist on every rent receipt being stamped, then a sum sufficient to pay the interest of any money borrowed for local improvement will be realized yearly. For instance, there are 293.524 houses in Sarun, and say that rent was paid in three instalments, as proposed in my pamphlet, the sum of Rs. 55,035 would be realised annually, and this, at 4½ per cent., would pay the interest of 12 lakhs of rupees. Now, Sarun is sadly in want of water, all the distributary *nullahs* which took their supplies from the big Gunduck have silted up, with the exception of the Daha and Shurai; money is required to clear out the beds of the silted-up *nullahs* and supply them with water from the Gunduck; and what better method of raising the interest of the money could be devised than the one I have now proposed? The only rule in my pamphlet which I consider at all Utopian is Rule 6, where the ryot is asked to sweep up the leaves of his trees for manure, that rule can easily be modified, or struck out altogether."

"If the ryots fold their cattle in the fields all the year round, the production of saltpetre will through time decrease, and the *nunyas* will have to seek for other work, which they will have no difficulty in obtaining, as they are a hard-working body of men." But as to depriving the potters, *ghors* and *kundhus* of their hereditary means of livelihood, such an idea never entered my head. I noticed the occupations of these castes in my pamphlet, with the sole object of pointing out the tremendous amount of legitimate manurial substances used by them in their works. And, considering the use manure is put to, in these thickly populated districts, my argument is and always has been, that a luxuriant growing green crop, such as indigo, *must* be grown to supplement the waste. Put this question in its true light before the intelligent landowners and farmers of England, and I am certain that they will one and all agree with me, and express surprise that the system was not adopted before."

THE SEPARATE ADMINISTRATION OF ASSAM.

THE approaching departure of the present Chief Commissioner of Assam, affords a convenient occasion for considering what have been the effects of the separation of the north-east frontier from Bengal, and creating it into a separate Government, under the title of 'the province of Assam.' It will be remembered that the ostensible reason for the change was that, as the condition of the north-east frontier districts was in many respects peculiar, it was desirable to have for them a government which would be nearer them, and would have ampler time and opportunity to consider their special wants. There were not wanting at the time, many who said that this was only a specious argument, and that the real object was to create certain well paid appointments. A consideration of the work that has been done during the time the Commission has been in existence, will shew that the latter view, if cynical, has at least been found to represent very accurately all the benefits of the change. And indeed, this might have been expected. For time and opportunity to study the wants of a country, are not all that is necessary to good government. It is necessary further, to have administrative ability to utilise the knowledge thus gained, and to be entrusted with power to carry out reforms. But no provision was made for either of these requisites. We appointed as Chief Commissioner, a man, the whole of whose administrative experience had been acquired in other lines. The Assam province being too small to have a Legislative Council of its own, had to go for every power it required to the Government of India. Now, however over-worked the Government of Bengal may be, it is certain that the Government of India has even less time to attend to the wants of Assam, and far less special knowledge to guide it. And this *a priori* consideration is not wanting in inductive proof. In 1873 almost every district in Bengal had its Road Cess Act, and its local funds for local improvement. Assam, so far as we have been able to make out, has no Road Cess Act in force in any district of the province. Certainly the two distinctively Bengal districts of Sylhet and Cachar have no such Act. The Sylhet district, which is for the most part permanently settled at merely nominal rates, is better able to bear such a rate than any district in Bengal; while more than any district in Bengal does it need its communications to be developed. It may be practically said to have no roads. Now had these districts remained under Bengal, they would have had Acts for this purpose, certainly not later than 1874. But the Government of India had no time to attend to the matter.

Assam, moreover, is so insignificant that it has nothing whatever to offer to any man of standing, while service in the province is necessarily permanent. Hence, if it is attempted to separate the service in Assam from the Bengal service, it is extremely difficult to find good men to serve in it. And yet the special danger of a growing province like Assam, is that bad government should become stereotyped therein. It is not too much to say perhaps, that no great improvement in Assam will be possible until most of the men who have been serving 20 to 30 years in the same grooves are removed, and new men with new ideas, able to grasp the changed conditions of things, and to see what is calculated to develope the province, are introduced. Without any unhandsome attack upon the Assam executive, it will be allowed that thirty years of exclusive service in the jungles of Assam, is not calculated to improve an officer. It must always be the interest of a service to keep its officers but a short time in backward districts. But under the present system, few men remain so long at one place as the officers in our jungles.

But let us pass from general considerations, to a review of the actual work done. In legislation, practically nothing has been done. No attempt has been made to recast that very unpractical Cooly Labour Act (VII. of 1873, B. C.). No Road Cess Act has been passed. With the exception of the expensive supervising establishment at Shillong, created to do what was previously done far better at Calcutta, there has been no alteration in the internal administration of the province. But perhaps the Commissioner had no opportunity to make any alterations. Let us examine the two departments in which practically he was uncontrolled, and see the principles by which he seems, from his report, to have been guided in his management of them. These are the Public Works and the Forest Departments. Since the formation of the Chief Commissionership, a very much larger sum than previously, has been allotted each year to Public Works in the province, but upon what principle has this money been expended? It would seem to have been a principle the very opposite to that which ought to govern the expenditure of public money.

As Gaul is described in the opening words of Cæsar's Commentaries, so the Assam province is divided into three parts. There is the Brahmaputra Valley or Assam Proper, the only Assam before Government went in for geographical legislation; then there is the Surma Valley; and thirdly the Hill Tracts between these two valleys. Now almost the whole of the Public Works allotment has been spent upon the Brahmaputra Valley, upon Shillong, and the hill-road to Shillong from Gowhatty, both of which are in the Hill Tracts. The money, so far as it has been spent in the Brahmaputra Valley, has probably not been wasted; nor would there be anything to say against it, if it had not been accompanied by an almost total neglect of the Surma Valley. But for the outlay upon the road to Shillong, there is no defence. The work of Government could go on just as well with a bridle road, as a cart-road. The Assam Government having been avowedly started as an experiment, it was surely a monstrous waste of money to make the first work in the province, a road to Shillong. Such a road can at best only benefit some 30 Europeans who live at Shillong. The populalation of the Khassia Hills is very small, and the revenue derived from it very trifling. There is no trade to develop, and the only traffic possible on the road is that of the stores consumed by our above-named 30 Europeans. To make this road the first work, was like a backwoods settler, making a magnificent carriage drive up to his log hut, before he had cut down a tree, or planted out an acre of crops. Future circumstances may make it important to have such a road constructed, but it certainly cannot be said to be needed now. It has not been, and probably never will be, of the smallest benefit to the province which Colonel Keatinge was sent to administer. In the present state of the province, and with its crying want of communications, the three lakhs thrown away upon this road are a scandal. What about the total neglect of the Surma Valley. What should be the test of the importance of a country? If it is to be simply its comparative area, then a glance at the map shews the Brahmaputra Valley to be vastly larger than the Surma Valley. It is in fact 20,683 square miles against 6,668 square miles; but then the population of the Surma Valley is, by the last census, 1,924,566 souls against 1,916,697 for the Brahmaputra Valley: it is consequently three times as densely populated. There is no comparative statement of the revenues derived from the districts separately, but notwithstanding that Sylhet (more than half the Surma Valley) is permanently settled, it is not probable that the total revenue of the Brahmaputra Valley is double that of the Surma Valley. As regards the tea industry, in the interests of which the money has been avowedly spent, the total outturn of the Brahmaputra Valley for the season 1876, was less than double that of the Surma Valley, which latter also is increasing its outturn at a much faster rate than the former. The outturn was 154 lakhs of pounds, to 79 lakhs for 1876-77, and the estimate for 1877-78 was 159 lakhs to 94 lakhs of pounds for the Brahmaputra and Surma Valley respectively. Upon no ground therefore is the neglect justifiable. In 1873, in the minute upon the Cooly Act then passed, the Bengal Government almost as good as promised to make communications between Sylhet and the rest of Bengal. Compared with the distance from Dibrughar to Dhoobree, the distance from Silchar to Dacca is small. And however good the Assam trunk road may be made, it will never be half the use of a road from Dacca to Sylhet. The latter would cheapen labour some 20 per cent. or 30 per cent. a head directly, and probably much more indirectly, if the saving of time and mortality which such a road would effect were taken into consideration. A road connecting Sylhet with Dacca might certainly have been made, if but a fair proportion of the revenue had been spent upon it in the last three years, and not wasted upon the road from Gowhatty to Shillong. Certainly the districts of Sylhet and Cachar have derived no advantage from their being put under a separate Government, and they would very gladly return to Bengal. The arguments by which the Administration Reports attempt to justify the above policy, shew a complete ignorance of the Surma Valley districts. The Surma is only navigable half the year, while the Brahmaputra is navigable all the year. If water communication can compensate for the absence of roads, then the Surma Valley most needs a road. But these arguments are not intended for use, for they are abandoned when the other roads are discussed. It is to be hoped that the new Chief Commissioner will have a truer sense of proportion and relative importance, and will not be led away by the mere name of Assam, into believing that this N.-E. Frontier province consists only of the Brahmaputra Valley.

The forest administration cannot be better described than in the words of the last Report published in 1876-77 : it "cannot be called satisfactory.". It seems to have been thought that it was only necessary to call a tract a forest, and that it would straightway become one. Most of the so called forest is practically inaccessible, and will probably remain so for many years to come ; a magnificent property on paper, but not worth much in the market. It should be further borne in mind that the hill people—who on a wild and savage frontier like the N.-E. Frontier, serve as a sort of break-water between us and the more savage hillmen behind them,—have been accustomed from time immemorial to exercise whatever rights they please, in what are now declared "reserved forests." So far as the Rs. 89,000 spent upon reserving these so-called forests in 1876-77, have been spent effectually, they have really been spent in disaffecting the half-hillmen who have hitherto been so useful to us. We all remember vividly the damaging and costly Lushai raids, and when it is seen that 745 square miles of Cachar which is but 1,285 square miles in all, has been declared "reserved forest," it can be seen at a glance how large is the disturbance of these half-hillmen, and how grave may be the political danger now brewing from this source. In one or two years of rigid enforcement of the Forest Act, every ally who could keep us informed of what is going on in the hills, will be driven into them, and will probably carry the news that we are going to turn out the Hill tribes, as we have turned them out. But no such idea seems to have entered into the philosophy of the retiring Commissioner. Anything for a forest ; that the forest is a property on paper only, may be readily guessed when we say that there are 745 square miles of forest in Cachar, and only 1,285 square miles in area altogether. After four years of experiment the change must we fear be declared to have been a complete and utter failure. However able and energetic the Chief Commissioner may be, there is nothing which he can do for the N.-E. frontier which he could not do far better if he had the power (even though burdened also with the duties) of a Lieutenant-Governor of Bengal.

LAND TENURE IN INDIA.

A CORRESPONDENCE on this subject has taken place in the London *Times* between Mr. Robert Elliot, of Mysore and Mr. A. Rogers, of the Bombay Civil Service, both gentlemen entitled to respect. Mr. Elliot very forcibly contends that if assistance were given to the ryot, and an assurance that the profits of an increased expenditure on the soil would be his own, a large number of wells would be dug, and he then shows, how valuable deep wells are even in the very extreme of drought. In the Cuddapah district, in the very midst of the greatest drought and when the tanks were all dry, there was a certain narrow tract of country which seemed like a paradise. On every side were splendid crops of maize, with fine large cobs of grain. This was due to deep wells, in which even then the water was from 8ft. to 10ft. deep, with a good spring at the bottom, and nine-tenths of the wells were due to the fact that the land was private property, subject to an annual quit-rent, or held rent-free for various reasons. Here then says Mr. Elliot is the key to the mitigation of famine in many tracts of Indian soil. Give the people such a tenure as will induce them to dig wells. The progress will be slow of course, but every well dug will at least be a step in the right direction. Mr. Elliot then proceeds to notice Lord Salisbury's request that the Famine Commission should enquire whether the ryotwary tenure tends to prevent the people investing capital in sinking wells. Nothing can be clearer says Mr. Elliot, than the fact that a tenure subject to an uncertain re-valuation at the close of each lease, can never attract capital to the land, and he contends that if for every well dug an abatement of this rent charge were granted, it is certain that the sacrifice of revenue thus made, would be amply recouped in times of dearth.

To this Mr. Rogers replies :—

> As Mr. Elliot, of Mysore, persistently endeavours to make out that the ryotwari tenure in India is not conducive to the investment of capital in improving the soil, by the construction of wells or other means of irrigation, will you kindly allow me once more to explain, what would be the position of a ryot who, under the Bombay Revenue Survey system so invested his money? Suppose at the time of the introduction of the revised settlement, he held two fields, one assessed at 12 annas (1s. 6d.) an acre as dry crop, and the other at three rupees (6s.) as irrigated land. At the revision on the expiration of the guaranteed terms of 30 years, it might be found that the former had been converted into irrigated land by a well having been sunk in it. What, then, would the revised assessment amount to, if the value of agricultural produce had in the meanwhile risen by from 50 to 100 per cent., railway communication had been provided, or the value of the land had otherwise become greatly improved from circumstances beyond the ryot's own control? Although the increase in value in consequence of the irrigation applied to it, would be 300 to 400 per cent., the enhanced assessment would probably not exceed 25 to 30 per cent. at the utmost, so that the rate per acre might rise to one rupee (2s.) or a little over, in contradistinction to one of probably four rupees (8s.) on the land originally recorded as irrigated, the difference between the 2s. and 8s. rates being surrendered to the proprietor of the field for ever. I have no hesitation in saying that no other landlord—call him rent-charger if you will—in the world would offer such liberal terms, and that if anything approaching to such terms were offered to their tenants by English landlords, much more capital would be invested on the improvement of the soil here than is at present the case.
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> But in case it should be said that those who at the time of revision for the first time were found in possession of lands already improved, it might be 50 or 100 years ago, were hardly dealt with, in comparison with the tenants of unimproved lands, it is as well to mention that even their fair right to levy a higher assesment on the former, has been foregone by the Indian Government, and only a slightly increased dry-crop rate imposed on such lands. What other landlord, but the Government of India would, for the benefit of his tenants, consent to such, it might almost be called, a Quixotic relinquishment of his rights?

Mr. Rogers is unquestionably right. Under the thirty years leave system, the ryot has practically a freehold of the soil. If the ryot does not invest capital in his holding, the reason is that he has not got the capital to invest: or that the return would not be proportionate to the outlay. Wherever the ryot has the means of doing so, he is already sinking wells, and has been long doing so, in Western India.

THE EXHAUSTION OF THE SOIL.

IN the article on *Tea-planting and Manuring* in our April issue, we spoke of the laws, which regulate the yield of a cultivated soil. "All soils recovered from Nature" we said "or all so-called virgin-soils, contain a superabundance of available plant-food, which nature has stored up by a tedious process of disintegration and decomposition, extending over hundreds of years. These soils, cultivated for the necessities or luxuries of mankind, will yield a certain number of crops annually, without it being necessary to restore the elements of plant-food withdrawn from the soil, and without any diminution of the quantity of produce. The number of crops which thus can be obtained, depends upon the original richness of the soil. Some soils will bear continuous cropping, without it being necessary to manure for five years, some for ten years, some for twenty years, but very few for a longer period than that. The produce of the land which is obtained during all these years, represents the stores of available plant-food which Nature had accumulated in the soil. Once this store is exhausted—and experience in America, Ceylon, and other countries, where virgin soil has been systematically cultivated, has shown that ten to twenty years suffice to utterly exhaust it—the yield commences to decline, and depends henceforth on the quantity of plant-food, set free annually by the action of water, heat, and atmospheric air." That is to say, during a certain period, varying from ten to twenty years or more, according to the original richness of the soil in available plant-food, the yield of an unmanured soil will gradually decline and sink to a minimum, depending upon the amount of available mineral plant-food, which from year to year can be set free from its chemical combinations by the action of heat, moisture, and atmospheric air. Below this minimum the yield does not sink perceptibly, though what the minimum may be, depends naturally upon the individual character of the soil; in a clayey or loamy soil, more plant-food will be set free and rendered available during the year, and the minimum yield of such a soil, will of course be greater than that of a sandy soil.

The minimum yield of any soil is of course, further subject to a gradual decrease, if cultivated without restoration of the mineral plant-food withdrawn in the crops, but this decrease is gradual, imperceptible and so small, that it sinks into insignificance before the rapid and alarming decrease, from the maximum to the minimum yield of average fertile soils, under an irrational system of cultivation. In Australia and America, as well as in India, we have striking examples of the effects of the exhaustive system, and great attention is now drawn to the subject in these comparatively new countries.

In the State of Michigan for instance, Professor Johnson has shown, that continued cropping had reduced the yield of wheat from over 25 bushels to about 10 bushels per acre, and this statement is confirmed by Mr. Ingersoll, and has been accepted as true by the Michigan State Board of Agriculture. Every body knows how this irrational system of over-cropping, regardless of the requirements of the soil, has reduced Florida, once the most fertile garden of America to a barren province, and we could adduce many other examples equally alarming. But our present purpose in referring to this subject, to which we have so often called attention, is to give our readers an opportunity to compare our views with the opinions of the well-known experimental farmer, Mr. J. B. Lawes, of Rothamsted, given in a paper contributed to an American agricultural publication. "From experiments conducted over thirty-four years, with results carefully watched and analysed, Mr. Lawes concludes that the soil—after the consumption of the original excess plant-food found in virgin soils—reaches a stage of normal productiveness, below which, as far as his experiments prove, it does not deteriorate." All soils, he says, "which have never been cultivated by man, possess a natural or standard fertility inherent to their geological formation, together with a more readily available fertility, due to the accumulation of living and decayed vegetable matter on their surface. The latter kind of fertility has long ceased to exist in England; whilst the former is as distinct as ever after centuries of cultivation. The normal standard of fertility once reached, all that is required is the destruction of weeds and careful cultivation, whereby the plant can take up all the food available. But then there is the undisputed fact, that every crop does exhaust the soil of a certain proportion of chemical constituents of plant-food, so it would seem needful that some further process, natural or artificial, be resorted to, to restore the amount removed and keep the land at the normal standard of fertility."

We are obliged for the above essence of Mr. Lawes' paper to our Allahabad contemporary, not having seen the paper as yet ourselves, but we take the earliest opportunity to place it before our readers as a proof how completely in this case, our own abstract deduction from natural laws and scientific principles, agrees with the experience and every-day observation of one of our most practical and eminent agriculturists. The only question remaining now to be disposed of, is, what is the minimum yield of an average fertile soil, and will it feed and clothe the agriculturist? In America, the most perfect system and instruments have been adopted to reduce the natural fertility of the soil to its minimum in the shortest possible time, but once this minimum is reached, the land pays no further for the labour expended on its cultivation; the minimum yield of it cannot sustain any longer the agriculturist and his family, and it is abandoned for new virgin soil to undergo the same treatment. The minimum yield of an average soil will therefore, it may be held, not feed and clothe the European farmer: but will it sustain his Aryan brother, will it sustain the Indian ryot, whose wants are so few, whose food so simple, whose covering, a strip of cloth? Let the Famine Commission answer the question.

India is one of the oldest cultivated countries, its tracts of virgin soil are few, and the remainder may be said to give only the minimum yield above described or to be reducible to it in a very few years, not under the impulse of increased communication, an export trade of food-stuffs. Now it is doubtful if this minimum yield of the soil, is sufficient to clothe and feed the agriculturist an enable him pay rent to the landlord. It is true, it may keep the ryot alive in favourable years, with rain and sunshine at proper times, but years of scarcity, years of drought will leave him without food, and without clothing, to die of starvation.

IRRIGATION IN BENGAL.

THE statement of Irrigation operations in Bengal for the month of March, presents some features of special interest. Unless figures are, in this instance, more than usually fallacious,—and little reliance is to be placed on deductions drawn from the mere breadths of land irrigated in a single year—it would really seem as if our great canal schemes had at length emerged from the difficulties and discouragements which beset them in their early years, and had entered upon a new era of financial prosperity. If such cheering anticipation as this, seem somewhat beyond what the figures before us will justify, it must, a least, be admitted that an increase of more than five-fold in the irrigated area, or from 76,211 acres in 1876-77 to 398,793 acres in 1877-78 is a very notable fact; and the public, and especially that large portion of it which contributes to the P.W. Cess, will be desirous to learn how far this improvement is likely to be sustained; or whether there is reason to believe it to be temporary only, liable at any time to be as suddenly reversed on the first occurrence of a season of copious and well timed rain-fall. Some explanation which will throw light upon these points, may, therefore, not be unacceptable to our readers. In the first place then, it is to be noted that the increase took place only in Orissa and Behar. In Midnapore, there was a falling off in the demand for Canal water. The figures are—

Areas irrigated.

	Orissa. Acres.	Midnapore. Acres.	Behar. Acres.
1876-77	28,311	32,238	15,662
1877-78	89,748	20,449	288,596

The decrease in Midnapore was due to the discredit brought upon irrigation by a succession of very wet years, in which the rainfall, so nearly sufficed for the requirements of the crops that canal water was almost superfluous. Those ryots, who took it, found the yield of their crop little or no better than that of those who dispensed with it, while their expenses were increased by the amount of the water-rate, to say nothing of the exactions of the petty officials of the Department. Hence a continuous decline in the breadth of land under irrigation, is shown by the following figures.

		Area irrigated.		Rainfall, inches.
1873-74	...	36,349	...	49
1874-75	...	72,318	...	53
1875-76	...	55,995	...	56
1876-77	...	32,238	...	75
1877-78	...	20,449		

The hopeful feature, however, in this part of the case is, that out of the 20,449 acres shewn in the above statement for the last year, 19,510 have been leased for five years—a fact which taken in connection with the discouraging results, which had attended the ventures of some previous years under annual leases, indicates an advance in the popular estimate of the value of irrigation in average years, which is full of promise for the future of our canals. Not that the financial out-look in Midnapore can ever be a very bright one; the fatal defect of the scheme, in the cardinal point of water-supply, forbidding any hope of a fully remunerative return for the outlay. But there certainly is a prospect of a steady demand for canal water, for an area and at prices which a year or two ago, could hardly have been hoped for. It may be remarked in passing, that the Midnapore canal affords some compensation, for its failure as an irrigation work, by the large returns it yields from navigation dues, the receipts from these sources in this and the Hidgellee canal in the past year having risen to Rs. 1,67,000.

Turning next to Orissa, we find that the areas irrigated were, in *khurreef* (all rice) 85,000 acres in 1877-78 against 25,604 in 1876-77, and in *rubbee* 4,495 acres against 2,399. The increase under *rubbee* is not of much importance; the total area, under dry crops in Orissa, being insignificant in comparison with that sown with rice, so that the revenue from this source is never likely to be large. But the sudden growth in the *khurreef* irrigation is remarkable, and its significance can only be understood, when it is stated in connection with it, that the water-rate was at the same time raised 50 per cent. or from Re. 1 at which it had stood in previous years, to Re. 1-8 per acre. The area of *khurreef* irrigation in the preceding year, the largest attained up to that time, was 26,070 acres, of which 21,813 were at the Re. 1 rate, while in 1877-78 the same area rose to 85,000 acres, bearing a water-rate of Re. 1-8. This most satisfactory result is attributable chiefly to the slow but steady growth of opinion in favour of irrigation among the ryots, stimulated by a rather deficient rainfull in 1877-78, and the vigorous application of the provisions of the new Irrigation Act for the punishment of theft of water; an act in which the Ooriyas had attained considerable proficiency during the year, when their stubborn refusal to lease almost led to the belief that they cared little for irrigation. To the surprise of all but the few officials upon the spot, who were acquainted with the real feelings of the people upon the subject, the Ooriyas last year went in for *khurreef* irrigation, wholesale. 85,000 acres have been assessed to water-rate, but it is known that some 10,000 more were irrigated in swampy parts of the country, where identification was difficult or impossible. The total area, actually irrigable, was not above 120,000 acres at the most, including *rubbee*; so that we have the remarkable fact that water was taken for $\frac{5}{6}$ths of the lands for which it was available. Nor does it appear that the irrigators have seen any reason to repent of their experiment. So far from this being the case, the latest returns shew that applications have been received for five years' leases for the greater part of the area watered last year—a circumstance which leaves, little room to doubt that after long waiting the slow-moving Ooriya has at last made up his mind, and that irrigation for the whole of the rice crop is in future to be a permanent institution, and an essential element in the agricultural system of the country. Unfortunately, the Government is not prepared to take full advantage of this propitious state of feeling. There is a great want of distributaries. At least 200,000 acres, are from this cause excluded from the benefits of irrigation, though commanded by main canals on which a heavy outlay has been incurred. In the panic times of 1873-75, the scheme was cut down to the smallest possible dimensions, and every work stopped, to the completion of which Government was not committed beyond possibility of escape; and as a vast extent of minor channels had not then been commenced, it follows that we have now very large areas, for the irrigation of which the greater part of the necessary outlay has been incurred, and which yet remain for the want of the means of distributaries, unirrigable. During the Lieutenant-Governor's visit to Orissa in the spring of the present year, orders were given for the submission of estimates for distributaries, for at least another 100,000 acres, these, it is expected, will not cost more than about 10 lakhs, or 5 per cent., in addition to the expenditure already incurred upon the schemes which now amount to close upon £2,000,000. Their construction, together with increased attention to drainage, will probably, at least, double the irrigable area in the course of the next two or three years.

Passing on to the Sone, we note that the greater part of the increase of irrigation reported during the year, took place under the canals, fed by this river. The irrigated areas were

			Acres.
in 1876-77	...	...	... 15,662
1877-78	...	...	... 288,596

Of the latter amount, 149,893 acres were *khurreef*, mostly rice; 129,012 acres *rubbee, viz.* wheat, barley, peas, and other spring crops, and 9,690 acres sugar-cane. Of the area under *khurreef* 64,000 acres were irrigated free of charge under the Patna Canal; the distributaries from which were in too unfinished a state to admit of regular distribution and assessment. On the other canals, a water-rate was charged of Re. 1 only for *khurreef* crops, and Rs. 2-8 for *rubbee*. Sugar-cane pays Rs. 5. The satisfaction of the ryots with the results of this, their first trial of irrigation on a great scale, was general. A magnificent *khurreef* rice crop was reaped, but unfortunately the plague of caterpillars and other insects which was common to all Behar, irrigated or un-irrigated, wrought a sad amount of destruction to the fine spring crops.

Large as the irrigated area was, it is known that it would have been much larger, had there been a sufficient number of village channels. These, the last links in the system of distributions, are made by the people themselves, and as the villagers usually take as lively an interest in preventing their neighbours getting water, as in obtaining it for themselves, it followed that for the most part the villages lying along the Government channels got water, while those lying further off, and which had to lead their water through the lands of intervening and hostile villages, had little chance of a supply. The total area irrigated was, nevertheless, about 60 per cent. of that for which water was available. Whether such a demand as this is likely to be permanent, or rather how long it may be before this is the case, cannot now be stated with any confidence. In *Orissa*, regular irrigation at such water-rates, as the people were willing to pay did not begin before 1872, and it has taken five years there for it to become something like an integral part of the system of cultivation. In Behar, it is probable that a shorter period will be required. Regular irrigation there did not commence until 1876-77. Three-year leases, at reduced rates, are now being offered on favourable terms, but it is too soon as yet to judge of the probable results. We have already seen that the total area irrigated in 1877-78 was close upon 400,000 acres. The value of the crops raised in this area, at the prevailing rates, was at least Rs. 1,33,50,000, of which about Rs. 84,00,000 was due to the canals alone, so that may be taken as representing the value of the increased yield due to irrigation. The Government demand at the rates charged, amounts to Rs. 6,30,000. Add to this Rs. 2,20,000 for receipts from navigation dues, and Rs. 30,000 for miscellaneous, and we find that the Government share of, the total profits from the canals, is Rs. 8,80,000 only,

AGRICULTURAL EXPERIMENTS IN THE CENTRAL PROVINCES.

FROM an interesting report submitted by Captain F. B. Morris, Assistant Commissioner, Pachmarhi, to the Secretary, Agri-Horticultural Society, Nagpore, and published with the annual report of that Society, we observe that the experimental planting of the olive tree had met with success. Captain Morris says :—

"I put the olive out and had it carefully matted in with grass, and notwithstanding the severe frost we had here, it is in no way injured and has grown well. I shall be much obliged if you could send me some more olive plants or would inform me in what way grafts or cuttings could be taken from the existing tree. It is probably rash to speak from the experience of only one tree, but I am very hopeful of it doing well here."

"Fine mahogany plants were treated in precisely the same way as the olive, but with a very different result ; tho' frost killed two of them, and the remaining three are stated to be looking very sickly, though still alive. It appears that the climate of Pachmarhi is very much against experiments in which trees of a delicate nature are concerned, as the frosts here in January are very sharp indeed, and every thing is more or less affected by it.

Regarding Prickly Comfrey, Captain Morris reports to the Society :—"The number of plants last year was 170, and I wrote to you and asked for instructions regarding the separation of bulbs and planting it out, which you were good enough to give me. I planted out 150 young plants in deeply dug and well manured land as recommended in the *Indian Agriculturist*, dated 1st May 1877. All these have done extremely well, and I found that if watered daily in the hot weather, and occasionally in the cold, that it produced about half a seer of leaves, and could be cut about once in ten days. The chief objection that I have to find with it is,—1st, that insects attack it greatly ; 2nd, that the slightest frost cuts the leaves off, and they take some little time before they throw out shoots ; 3rd, the uncertainty as to its being liked by cattle,—some horses will eat it greedily while others will not touch it. I tried to feed some cows and bullocks on the green leaves of it, but none liked it, and an instance of this is that one day when a bullock broke through the fence and got into the enclosure it was found to be eating *dhoob* grass there in preference to the comfrey. There seems to be little or no difficulty in getting it to grow when the ground is trenched, and manured and watered.

Italian red clover and English lucerne grass seeds were received too late to make a successful experiment. Last year we observed some lucerne seeds were sown precisely at the same time of the year as the red clover and English lucerne seeds, and with exactly a similar result ; the seeds germinated freely, and then notwithstanding their being well watered they nearly all died down. In the year under report some lucerne seed was sown as soon as possible after the rains were over, and the result has been an excellent crop, and Captain Morris feels convinced that the same would have been the case had the red clover and lucerne been sown at the same time.

The experiments Captain Morris made to plant out seedlings of the Carob tree, were not successful. After soaking the beans well for 24 hours they were sowed in baskets, and nearly all germinated freely ; a piece of ground was prepared and cleaned, and holes dug which were filled with old decayed manure, but the experiment was far from successful, plant after plant died, and another was planted in its place, but they make little or no growth ; and at present they are not very promising. Captain Morris is at a loss to understand why they have not done better, as they did excessively well until planted out and he thought at first that their roots might be injured in transplanting, but some he had transplanted before have done little or no better than the others. He thinks and perhaps rightly, that these seeds should be sown where the trees are to be grown, though the instructions sent with them are that they should be sown in boxes.

The report concludes with the details of a very successful experiment with Saugor potatoes this year. In June 1877, Captain Morris sowed 5 maunds 15 seers of Saugor potatoes in light soil, in a portion of which potatoes had been sown the year before ; the ground was ploughed up in December six months previously, and again ploughed over and slightly manured with old manure. The cost is roughly estimated at :—

		Rs.	A.	P.	
Price of potatoes	...	16	14	0	(Potatoes were extremely cheap in Saugor that year.)
24 coolies ...	...	4	8	0	
12 pairs of bullocks	...	6	0	0	
21 carts of manure	...	18	0	0	
Total Rs.	...	45	6	0	

The first potatoes were taken up on the 9th September, these young potatoes were sent in the *dhallies* to the subscribers to the garden for four months, and 17½ maunds were thus used ; 22 maunds were sold at Rs. 4 per maund, 2 maunds have been sown early in February and are looking very well, and one maund is to be sown shortly ; on the outturn of these last sowings a report will appear next year. Total outturn 42½ maunds. The outturn is thus shown to be over 8 fold.

Financial results are .—

Cost of potatoes &c.	...	45	6	0
Outturn 42½ maunds if sold at Rs. 4 per maund, the price that could have been got ...	...	170	0	0
Net profit	...	124	10	0

Captain Morris is trying an experiment on a much larger scale this year in new ground he had ploughed up in November, and again ploughed when rain had fallen ; but as potatoes in Saugor on account of scanty rain-fall are this year very much dearer, the financial results are not expected to be so good proportionately.

YIELD OF COTTON PER PLANT.

MR. NEILL, the officiating Commissioner, Nagpore Division, in submitting the annual report of the Hony. Secretary to the Agri-Horticultural Society of Nagpore, says :—In paragraph 8 of the report the results of further experiments to test the average outturn of clean cotton per tree or bush are described. Last year one experiment with 64 plants showed that ½ oz. of clean cotton per tree was the average obtained, and a second experiment with 56 plants gave an average of 3 oz. per plant ; upon which Captain Macdougall remarked, "there is a mistake somewhere which will be inquired into.' This year, writes Captain Macdougall, "a plot "measuring 22 by 41, with plants standing 3 feet apart every way "yielded 3 lbs. of clean cotton. There were 98 plants in this "area, and we get the same yield of nearly ½ oz. per tree. The "first plot was allowed to stand over for a second year, and the "return yielded was a little under 4 lbs., seemingly showing that "the second year's growth was a stronger and more prolific one. "It seems to be an absurdly low yield obtaining only ½ oz. per tree "but there seems to be no reason to doubt it, and this shows the necessity of a much more careful cultivation on the part of a ryot, "if he wishes to get a really valuable outturn. The present "outturn of the best lands does not average over 40 lbs. per acre, "and this from many thousand plants. Consequently if the above "experiment is any criterion many hundreds of plants in a ryot's "field yield nothing. The lesson to be learnt by a ryot therefore "would be thinner sowing, and, where manure is obtainable, its "utilization on some such economical plan as the one now reported "on, of planting three feet apart in drills also three feet apart, and "to each pinch of seed a supply of manure." I venture to think that, however valuable the advice given above to cultivators may be (and I think the plan proposed would ensure good crops), the conclusion arrived at by Captain Macdougall is not a strict deduction from his premises, and that the truth of his premises themselves has not been fully demonstrated. If cotton plants will on an average yield only ½ oz. of cleaned cotton, it does not follow that a system of cultivation which could not give more than 140 or 150 lbs. of clean cotton per acre would be the best; a larger number of plants might be grown on the same area without any reduction of the average yield per plant. Doubtless an outturn of 140 lbs. per acre would very far exceed the existing average, but I take leave to doubt that 40 lbs. per acre is the present average "of the best lands." A general average of 50 or 60 lbs. would, in my opinion, be nearer the mark, and, secondly, I must consider the experiments, according to which the average outturn obtainable from a number of cotton plants does not exceed ½ oz. per plant, to be inconclusive. With careful cultivation I believe a larger yield could be obtained, and obviously the only value of an experiment of the kind would be to show what would be the average yield of a considerable number of cotton plants under careful cultivation and favorable circumstances. I have no experience of my own to place against Captain Macdougall's, but it seems to me that the results of his experiments at the Model Farm do not confirm the results of experiments at the Maharaj Bagh. In his last report on the Model Farm he said: "It will be remembered that in the year 1875-76, some six acres of heavily manured "land returned us the large yield of 304 lbs. of clean cotton per "acre. These figures were for this part of the country startling "and did not escape some challenge. I am glad to say that "we have this year successfully capped our former outturn in "obtaining a yield of 326 lbs. of clean cotton per acre." Now if the espacement of the plants on the plots in the Model Farm was the same as in the Maharaj Bagh, an acre must have contained less than 5,000 plants, and the yield per acre, at an average of ½ oz. of clean cotton per plant, would not have exceeded 150 lbs. It would seem to follow—either that each plant yielded on an average more than ½ oz., or that a greater number of plants (more than double) went to the acre than is recommended as the result of the experiment in the Maharaj Bagh.

IRRIGATION IN SARUN.

THE Sarun Irrigation scheme to which lately attention has been drawn by one of our contemporaries consists we find, of a canal led off from the river Gunduk, by which an abundant supply of water will be thrown into five or six of the principal nullahs of the district. These nullahs were formerly spill channels, by which when the Gunduk overflowed its banks, a portion of its waters were carried off into the Ganges. Their bed and banks have consequently been raised by silt deposits, so that though not of much value as drainages, they will serve a very useful purpose as distributaries. It would, of course, have been desirable to keep the two functions of drainage and irrigation distinct, but this could only have been done at a large outlay, and the scheme which is now being carried out is simply the readiest and cheapest means of affording a water-supply to the district. It originated in 1876, during a time of severe and protracted drought, and was proposed to the Government of India as an Imperial work, but refused, as no security could be given that it would prove remunerative. After various languid efforts to start it on the basis of a local guarantee, the present Lieutenant-Governor at last visited Chupra, and discussed the question with some of the leading gentlemen of the district; the result being that in December last a meeting of planters, zemindars, and Government officers took place, at which a scheme for carrying out the works, under a guarantee by some of the planters and the Maharajah of Hatwa was adopted. The estimated cost of the work was about six lakhs, and the amount of guarantee promised at the meeting Rs. 28,000.

The project in this form was again submitted to the Government of India, and again rejected, as not fulfilling all the conditions required in works to be carried out from Loan Funds. Sir Ashley Eden then determined to make the scheme provincial. Two lakhs have been granted for the current year, and two-and-half for next year, the total cost having been reduced to Rs. 4½ lakhs. The works are in full swing. The three principal cuts from the proposed supply channels into the nullahs are finished, and some thousands of people are now engaged on the excavations and embankments at the head.

The amount now promised in the shape of guarantee is Rs. 22,000. This will cover the whole charge for interest at 4½ per cent. The cost of maintenance and reduced administration, estimated at about Rs. 40,000 annually, will fall upon the Government, which must recoup itself as it can, by the sale of the surplus water which may be available after the requirements of the guarantors, who will of course have the prior claim, have been satisfied. Each guarantor will be entitled to such a supply as will, at the rate which will be charged per acre, or per maund of indigo manufactured, represent the amount of his guarantee. The rates are to be fixed by a Committee of planters and Government officers. Thus, supposing the water-rate to be Re. 1 per acre only, a gentleman guaranteeing Rs. 5,000 per annum, will be entitled to a supply sufficient for the irrigation of 5,000 acres. After the demands of the guarantors have thus been met, there will be an ample margin of supply for sale on Government account. The Commissioner who originally drafted the scheme could suggest no less onerous description of security for the guarantee, than a conditional mortgage on the indigo concerns interested, but suggested that the Government law officers should be consulted upon the point. It is probable we learn that the mortgage idea will be abandoned, as it certainly ought to be, and that the guarantee will take the form of leases for certain areas for a term of years. The point is still under discussion. The views of the leading planters have been taken and some definite result is likely to be arrived at a meeting which will come off in a few days.

A scheme for the water-supply of the Hooghly district, on a basis similar to the above, is now under the consideration of the zemindars.

TENANT RIGHT IN BENGAL.

THE agrarian policy of Sir Ashley Eden is becoming well defined and clearly understood. It may be described as being intermediate between that of Sir George Campbell, and that of Sir Richard Temple. The first of these three Lieutenant-Governors devoted his whole energies to the improvement of the position of the ryots. He neglected none of the methods by which their condition can be elevated, as education, the efficiency of rural justice, the development of communications; but it was to securing for them tenant-right that he gave his most particular attention. Had Lord Mayo lived, Sir George Campbell, with the assistance of a sympathetic chief, would have settled the question once for all, by passing a decided and comprehensive law, to give the ryots of these provinces the security which has produced such excellent results in Bombay. The dagger which struck down our most popular Viceroy put an end to many hopeful projects, and under Lord Northbrook, Sir George Campbell could not wield the powers of legislation for the accomplishment of his purpose. He, however, managed to do a great deal in his executive capacity. Rights long dormant were revived, and in many parts of Bengal it became impossible for the landlord to ignore in practice, the privileges which his tenants possessed in theory. A good example was set on Government estates, and on those managed by the Court of Wards. And, almost imperceptibly, the cultivators learned to hold up their heads, to become more independent, and therefore more industrious. Sir Richard Temple's policy was obscured by a cloud of fine phrases, in which he protested his love for tenant-right and for landlord power, his respect for the ryots, his admiration of the zemindars, his general approbation of everything and of everyone. Those who know this accomplished administrator are accustomed to gather his views rather from what he does, than from what he says, and his acts showed him to be as keen a partisan as his predecessor, only upon the other side. Like Austria in the play, Sir Richard Temple might be addressed as,

> "Thou ever strong upon the stronger side,
> Thou fortune's champion, that dost never fight
> Save when her humorous ladyship is by,
> To teach thee safety."

Finding that the zemindars had the upper hand in Bengal, that it depended upon them whether a Governor was praised or abused, by the part of the native public which can make its voice heard, he lent them the use of his talents and his position. And in their hands, he proved a most sharp and effective instrument. The principles of management introduced by his predecessor on Government and Wards' estates, were abandoned. The whole influence of the Executive was given to support the enhancement of rent, by such means as the arbitration of landlords themselves. An Act was passed, empowering the Lieutenant-Governor, whenever he apprehended disputes of an agrarian character, to confiscate the interest of ryots in their tenures, by empowering his nominees to raise the rents on grounds which were not valid under the ordinary law. A Bill was introduced to render all occupancy ryots subject to enhancement no novel principles—that is to say, for universal confiscation. Had it been passed, the whole country would have been for years, the scene of litigation and legalised plunder, and in the end of rack-renting and pauperism. Fortunately it perished with the departure of its author.

Sir Ashley Eden has, in managing the Executive, reverted, at least is some measure, to the system of Sir George Campbell. In Behar, where their condition is worst, he has done much to protect and encourage the ryots. A record of their rights on Government estates, and the prevention of illegal disturbance through the magistracy, have been of great use to them. It is, however, more of his legislative action that we wish now to speak. He has declared himself altogether opposed to all schemes for subjecting statutory tenures to encroachment—in the sense of enhancement of rent—on grounds now illegal, under the pretence of fixing rules for regulating the assessment. This is a great gain, as it was to be feared that finding the Bill pending from his predecessor's time, he would have gone on with it, on the general principle of 'supporting the acts of the administration.' In place of that abortive measure he proposes one to make undisputed rents recoverable by a summary process, and to vest decision of enhancement cases, when required, in the hands of Revenue Officers, acting as they do in making a settlement of the Government revenue. These provisions, which are in favour of the landlord, he would balance by one beneficial to the tenant, making the right of occupancy everywhere transferable. The latter measure would have many advantages. It would tend to avert a great economical danger—the gradual substitution of tenants-at-will for occupancy ryots; a process which is now going on everywhere, and with greater speed in the more advanced districts. Where a ryot dies without heirs, or quits his holding for any reason, it falls to the zemindar, by what Lord Dalhousie would have called the right of lapse, and is let out by him on a lease, expressly barring the new cultivator from the acquisition of any customary rights whatever. If occupancy privileges could be sold, this right of lapse would cease, and the consequent contraction of the circle within which we have limited tenant-right, would be prevented. Moreover, the privilege of occupancy ryots having a tangible money value, would be more noticed and prized, and we should not see them ignored, and violated by the strong hand, as in Behar. The tenants would have some security to offer lenders, and this would often prevent them from becoming a burden to the State in time of scarcity. On the whole, this is a most hopeful proposal—and one which would confer a great benefit on the State and the people.

At the same time it must be noted that the measures which are being taken to facilitate enhancements, will be most injurious to the occupancy ryots. A part of the value of their tenures is derived from their statutory privilege, that the rent they pay shall be considered fair and equitable—that is, shall not be raised, until the contrary proved. This presumption of law throws the *onus probandi* on the landlord seeking to alter customary rates, and experience shows that this is a most important safeguard. To take away a privilege having a pecuniary value, without giving any compensation to the loser, is a harsh act, and one which it would be difficult to defend on any known principle. And yet this is the meaning of substituting settlement through a Deputy Collector—adopting the inquisitorial method of procedure—for suits in which the plaintiff has to prove his case. As for the proposal to grant more summary methods for realizing undisputed rents, we look on it as merely illusory. As a matter of fact, such rents are paid with perfect regularity. The powers of a zemindar against a defaulting tenant, are extraordinarily great:—they include the distraint of his standing crop before judgment, the arrest of his person, sale of his goods, and forfeiture of his tenure after judgment. In practice, these powers prove sufficient to ensure the realization, not only of the whole rent, but of some twenty-five per cent. over and above, in the form of illegal cesses. Wherever greater stringency is demanded, it is with the intention of using new powers for some illegitimate purpose. Thus, after a decree for rent, fifteen days is now allowed for payment before the tenure is forfeited. Many zemindars wish to see this time of grace abolished, and the decree to carry with it instant eviction, in order that ryots may be frightened from disputing unfair claims, or those which are doubtful, through fear of entire forfeiture of their interest in the soil, in the event of the case going against them. It is notorious that in Behar, the right of distraint is abused to compel submission to unjust demands, and this practise was even denounced by a recent Commission as a cause of a local scarcity. Any new powers of the same kind would be valued only so far as they could be used for similar purposes.

Sir Ashley Eden appears, then, as the author of two distinct proposals—one favourable to tenant-right, the other injurious to it. We do not pretend to be able to weigh the two against each other, and to say whether good or evil preponderates. But we have to note the important fact that the ideas suggested by the zemindari party have already been embodied in a Bill, which has made some progress, and is likely to be passed, while those which have come from the other side still float in the cloud land of letters and minutes. Can it be that the ryots are again to receive fair words as an equivalent for harsh measures? It is no doubt easy to pass into law any Government suggestion favourable to the landlords, who are ably represented both in the local and Imperial councils, while whatever they oppose has to contend with difficulties. We would suggest that the two Bills might be introduced together, and proceed with equal steps, or still better, that they should be amalgamated. In this way only, can we see any security against our obtaining only what is bad in the proposed arrangement. Perhaps the best plan of all would be to let the subject alone, until a change in the political atmosphere may permit of its being settled in a ryotwari sense; but this, we fear, is not to be.

THE LOCUSTS IN SOUTHERN INDIA.

SURGEON-MAJOR G. BIDIE, the Superintendent, Government, Central Museum, Madras has sent into Government an interesting report containing additional information regarding this pest. It appears that so far as can be ascertained from casual notices in the Transactions of the Entomological and Linnæan Societies, &c., two kinds of locusts have, from time to time, appeared in India, viz., *Œdipoda migratoria* (*Gryllus migratorius*, Lin.) and the *Acridium peregrinum* or "Criquet nomade" of Oliver. Both are equally destructive and common to Asia Minor, India, Algeria, Arabia, Persia, &c., the specimens of the locust now so prevalent in the Madras Presidency are stated by him belonging to *Œdipoda migratoria*, an authentic and comprehensive account of the practical natural history of the locust, Dr. Bidie states are to be found in Volume XV of the "Linnæan Transactions" in an article by J. Smirnove, Esq., F. R. and L. S., Secretary to the Russian Embassy, and in Tristram's "Natural History of the Bible." Mr. Smirnove had the advantage of watching a terrible visitation of the locusts in the Crimea and southern provinces of Russia and records most important facts regarding their development, duration of life, habits, and voracity, and also gives a brief sketch of the means adopted for their destruction.

Dr. Bidie introduces these observations with a few remarks on the physiology of this pest. The locust after leaving the egg has no dormant state, and is most destructive both in the *larva*, *pupa* and *imago* stages of its life. According to various authorities locusts are eaten by the Arabs, and Mr.

Tristram who tasted them says they have a flavor somewhat like shrimps. One point of very great importance in the history of the locusts is the period at which they lay their eggs and the time occupied in hatching. According to Mr. Smirnove the insects in Southern Russia pair in August and drop their eggs and die in September. The eggs, he states, are deposited in the ground in small bags composed of a thin membrane about the size of an almond. Each of these bags is said to contain from 80 to 100 eggs, so "that an idea may be formed of their amazing fecundity." From September to April following, or during the winter, the eggs lie buried in the earth, but in the latter month they are hatched by the increasing warmth of the sun. The insects then continue in the larva state through May, and are seen creeping about in myriads "in the shape of white beetles." While in this condition they spread over the fields during the day, but collect at night, "and thousands of locust hillocks may be seen in one corn-field." This, as will be afterwards seen, is a most important fact in their history.

After remaining two or three weeks in the crawling state, they begin to leap and get very destructive to crops. They also spread more and unite in such multitudes that places, many miles in extent may be covered with them "in columns of from 6 to 10 inches thick and upwards." In June they are in the pupa stage and incapable of flight, but more voracious than at any other period of their existence. About the beginning of July they cast their skins and become perfect insects and capable of flight. In this stage, too, they are extremely destructive, and convert in a few hours cultivated lands into "absolute deserts." In August, as already stated, the locusts pair, and in September they deposit their eggs and perish.

Regarding the means to destroy this insect Mr. Smirnove remarks :—"Various methods have been adopted to destroy the insect either by ploughing the fields and collecting the eggs, or, in the spring, at the dawn of day, while the insect is yet in the crawling state, by setting fire to straw which has been thrown over the locust hillocks, or by sweeping them into sacks and destroying them. In the leaping state wide sacks are employed, into which they are driven by a person furnished with a broom, or by means of deep trenches dug in the field, into which they are driven and buried. In the flying state there is no effectual method to destroy them. When a flight of them in this state alight on a field, the country-people assemble with rattles and other instruments, and by making a great noise succeed in driving them away for the time, but it is only to take refuge in the neighbouring fields. By these methods much of the vermin was destroyed ; but there still remained immense quantities, and their numbers daily increased from the adjacent countries ; for, at the time when in new Russia the locusts had not yet attained the winged state, legions of them made their appearance coming, as is supposed, from the Turkish provinces. Thus the inhabitants, who had been diligently laboring to cleanse their lands of the insects by which they were already desolated, were no wise relieved from them, seeing as they did their possessions infested by others from unknown regions, and all human means seemed unavailing to avert the famine with which the provinces were menaced."

APRICOT CULTIVATION.

THIS valuable adjunct to agricultural operations in general, and the planting interest in particular, does not appear to meet with the attention that it deserves, considering the valuable products obtainable, a few of which are as follows :—*Oil*, bright amber yellow, burns with a clear flame : bazar name 'ranghan-i-maghz-i-khubani'—*Oil-cake*, when boiled and made into a warm mash is good for feeding cattle.—*Preserves Pickles, Chutney*,—*Charcoal*, mixes well with the produce of conifers.—*Wood*, for burning, furniture, and implements ; the colour of the heart wood is reddish.—*Gum*, amber-coloured and soluble, obtained by incisions in the bark of the tree, when dried it resembles the *khoobani* bazaar name, 'gond-i-shaft-alu'.—*Brandy*.—After mastication is applied for ophthalmia.—*Dried, Fruit*, used as a laxative and refrigerant in fevers.—*Sweet almonds*, produced by some of the varieties, notably from the Haisha and Broozha kinds.—*Prussic acid*, the bitter almonds or kernels when subjected to distillation with water produces the peculiar smell and poisonous properties of hydrocyanic acid.—*Oil*, can also be used for cooking purposes, but it has a bitter almond flavour. Gold and silversmiths use a *hot decoction* of the unripe fruit for the purpose of cleaning and giving bright lustre to old metals ; the article is first heated and then plunged into the decoction ; old coins can be cleaned in this manner. This production is also used as a *mordant* or brightener in dyeing with safflower and other colours that will not bear alum. Towards Ladak and Yarkand the dried fruit, powdered, and looking like coarse brown flour, is sometimes mixed with tea.

Subjoined are some facts connected with this subject. If other *cognoscenti* will furnish details of their experience, the result will be ultimately beneficial.

When ripe the apricots are gathered daily and brought to a shed near the factory ; they are there heaped together, the heap being stirred daily for about a week, when they should be washed free from the impurity of the pulp, which by this time has begun to ferment and emits a fœtid smell ; if left longer than a week in this state, the kernels become rotten, and the oil thick and useless for burning ; the reason for allowing the fruit to rot is to save the labour of storing each apricot separately, which would occupy so much time, this plan, of course, merely refers to the quickest method, and when no use has to be made of the fruit and only the expression of oil from the kernels is the object in view ; after washing the shells they should be well dried in the sun and put away in boxes, to be broken when time and opportunity offer for this purpose ; after the kernels have been removed from the shells and during the day before despatch to the *koloo*, they should be well sunned, then comes the expressing of the oil ; the operations of breaking the shells and expressing the oil from the kernels should be done on rainy and non-tea-manufacture days, and on other occasions when the work-people have nothing else to do ; the tea factory is as good a place as any to let the men work in ; kernels which have been shelled many months become dry and yield harldly any oil. Two coolies can break and separate from the shell, about 18 seers of stones in one day. Nineteen seers of fresh stones yield six seers of kernels. Twenty-six seers of fresh kernels yield twelve quart (beer) bottles of oil, *i.e.*, slightly over two seers of kernels per quart bottle. Outturn irregular, being dependant on the proper adjustment of the pollen.

Two men can press out fourteen seers of kernels (= six-and-a-half quart bottles of oil) in one day, with an ordinary native *koloo*, (oil-press). If the oil is expressed at a native owned *koloo*, the owner does not take money payment but receives one-eighth of the outturn as his share for his labour and use of his mill. It is necessary to send one servant to assist him and see that the proper quantity is expressed. A quart (beer) bottle can generally be purchased from the villagers for four annas.

When it is desired to manufacture preserves, the fruit, from the best trees, is carefully picked, peeled, and stoned ; after which it is boiled, adding one-fourth more than its weight of sugar ; the length of time required for boiling depends upon the quantity about to be made. *Gathering* should take place before the fruit is quite ripe, or it will be mealy.

A very good brandy can be distilled from the fruit (pulp) ; in this case the fruit is also carefully separated from the stones, and the further proceedings are analogous to spirit manufacture.

The best varieties are :—

Early masculine, ripens earliest —*Large Early* or *Precoce*, very agreeable juice.—*Blenheim* or *Shipley's*, great bearer, sure ripener, hardy.—*Hemskirke*, sure ripener,—*Breda* or *Brussels*, a well-known preserving fruit ; the former a small yellowish-brown unspotted kind, the latter, large compressed variety with rich sanguine blotches on its *sunny* side. —*Royal*, very rich flavour.—*Moorpark*, finest flavoured.—*Musch-musch* very sweet.—*Orange*, for preserving.—*Roman*, good bearer.—*Turkey* Haisha, a Syrian kind, delicious and possessing a sweet kernel. All the foregoing are cultivated in England. In the South of Europe there is a sort extensively cultivated for preserving ; the French call it *alberge*, which is probably a corruption of *Al Berkhaoh*, the Arabic name of the *Mishmish* variety. It would prove suitable for the plains of India.—*Boorsha*, very agreeable, sweet kernel, grown only at Soongnum (9,000, feet above sea-level), in Upper Kunawar, Bissahr, one of the Simla Hill States.—*Prunus dasycarpa*, the black apricot, a variety with dark purple velvety fruit, is cultivated in Cashmir, Afghanistan, and Beloochistan, suitable for preserving. Kandahar, in Afghanistan, produces eleven varieties, *viz.*, *kaisi* (an excellent smooth skinned apricot, produced from grafts), *Charmaghz*, and *Charbaghi*, these three are the most esteemed ; they are preserved for exportation to India by drying in the sun ; but previous to this process the fruit is sliced open, its stone removed and split and the kernel having been blanched, is replaced in the fleshy part of the fruit ; in this form the apricot is called *Khubani*. The variety named *Pas ras*, is as its name implies, the last to ripen there are two kinds, large and small. These, with other varieties named ; *Surkhcha*, *Sufaidcha*, *Plan*, *Shams Shakarpara*, though generally consumed in a fresh state, are also dried, but the stone is not removed, these are called *Tuifi* ; they are very acid, being generally dried before quite ripe ; they are chiefly used as a relish, and as a component of some kinds of sherbet. The general bazaar name for the dried unripe apricot is *Kishta*; other names are *Astah*, *Khushta*, *Astah-ke-magz* (dried fruit for eating, without kernels), *Khasta* (best dried apricots). The *Khubani* sell at about four seers per rupee; the *Khasta* at two seers per rupee, in the Punjab bazaars.

CULTIVATION.—*Choice of Trees.*—Those who have to select, whether from stock of their own, or from the nursery, should first see that the junction between the stock and the scion is complete, and thoroughly healed. If any gum or other exudation appear on any stem, by all means reject the tree as to present use. Two or three years' trained trees are the most eligible, and such should possess at least two branches on either side, and a central one if possible. Care should be taken to select those in which the side branches are of about equal thickness.

When full grown, the tree attains a height of 30 to 35 ft. and girth of 5 to 6 ft., crown close, spreading, rounded, commences to bear fruit when 5 to 8 years old.

Propagation.—Is best done by budding. Some choose the apricot stock, or those from the kernels; others prefer the plum stock; the latter, however, has been much complained of in late years. The English nurserymen have what is called a "commoner" stock, which appears to be a sort of wild plum, and which, in general, answers pretty well. For India the peach stock is best.

For dwarfs, bud at eight inches from the soil; for half-standards, at 3 feet; and for standards at five feet.

Standards are several years coming into bearing. The fruit produced against walls is the finest, but that from standards is the best flavoured.

Period of Planting.—Those who wish to gain time may plant successfully in the first or second week of October; any time, however, from that period until the early part of March will do.

Soil.—A good, sound, rather unctuous loam is best, using a little ordinary vegetable matter, but no manure, unless on the surface. Do not make the soil deeper than 18 inches.

Aspect.—South and West are best, though East is also suitable in warm situations. Standards grow best with a Southern aspect.

Elevation.—Fruit ripens best between 5,000 ft. and 9,000ft.

Training.—The branches should be on an average from six to eight inches apart, and kept as horizontal as possible. The ordinary fan-training is also well adapted if care be taken to pinch over-luxuriant shoots in time.

Pruning.—Must be regulated by the knowledge that, with the exception of such as the moorpark, many varieties bear chiefly on the shoots of the previous year; the moorpark, mostly on spurs, two and three years' old.

Summer Pruning.—Take off all fore-right shoots, and others that are irregular and misplaced, reserving those that are not too vigorous, and that will train in well for next years' bearing. If done early the finger and thumb will supersede the necessity for the knife. Continue to nail the shoots to the wall, as necessary, tying down, or nailing in all short-jointed, weak-looking sprays. Over-vigorous shoots may be stopped early and be thus induced to put forth more fertile laterals.

Winter Pruning.—Had best be done as soon as the leaves have fallen, though it may be carried on until the buds begin to swell, cut out any naked-looking shoots not more than four or five years old, avoiding amputations in the larger limbs, and get their places re-occupied by younger and better branches. Keep a leading shoot at the end of each branch. Vigorous shoots of the last year shorten as far as the points seem ill ripened, weaker shoots about one-third. This promotes the production of laterals for next year's fruiting, and gives a fuller supply of sap to the blossom buds. Cut off grass, fore-right spurs; but lateral spurs may be retained, as they sometimes produce blossom-buds, as they nearly always do in the moorpark. Let also, all decaying or imperfect points be pruned off.

Espaliers.—Are to be formed as those on walls. Standards only require dead, crowded, or chafing branches to be removed. It readily coppices.

Disease.—When an apricot gets diseased, it is much more profitable to replace it by a younger, than to attempt renovation.

Flowers.—In January, May according to elevation, the fruit ripens between June—September for the same reason. Foliage turns yellow first, but becomes red before falling.

Thinning.—Should commence as soon as the fruit is large enough for tarts; no fruit being left nearer, finally, than about five inches to another. The thinning may be done twice.

Gathering.—Should take place before the fruit is dead ripe, or it will be mealy.

Mildew.—Is often the most formidable assailant of the apricot as it usually arises from excess of moisture to the root. Draining the border, and mixing lime with the soil, has, in such case, been found efficacious as a preventative; and, at the same time, sulphur, as a well-known and powerful antagonist of the mildew, may be carefully dusted over the tree. As nothing grows under the shade of the apricot it is as well to plant them on ground not required for other purposes. The old English name is *aprecoke*, of which apricot is probably a corruption. Like many other domesticated plants, the native country of the apricot tree is unknown; from the name it bore among the Romans, *Armeniaca*, it would appear to have been a native of Armenia, to which country it is, in fact, assigned by both Pliny and Columella. Modern botanists incline to the belief that it is indigenous in the Caucasian region, and that it was introduced into Europe, by the Romans, about the same time as the peach tree. It has, however, been represented by Monsr. Regnier, a French writer, that "it is rather a native of the Oases of the Desert of Egypt, an opinion that seems to have been formed upon the following circumstances: firstly that the modern Greeks call the apricot *Perikokka*, which is nearly the same as the Arabic name *Berkhaoh*; secondly that vast quantities of this fruit are actually dried in the Oases and brought to Egypt, where they are called *mish-mish*; and thirdly, that the early period of the year when its blossoms unfold, is indicative of a southern rather than of a northern climate." As to the latter observation, it seems to be completely at variance with facts, for the earliest of trees in leafing are the Tartarian honeysuckle and the sanguine hawthorn, which are both found wild in the coldest part of Asia. It is, perhaps, impossible to demonstrate, from any published evidence, that it is really found wild in Armenia. Royle inclines to the belief that it came from the Cabul mountains.

The apricot is frequently found in the hills between the rivers Ganges and Jumna, apparently wild, as well as the walnut, peach, and pomegranate. The two latter appear to be perfectly wild, at least they are found away from villages and covering the sides of hills; but the latter having been formerly much more populous than they now are, many sites of villages and cultivation are concealed and overgrown with jungle, so that it is difficult to recognise them.

The apricot is so generally planted round Himalayan villages, that there are few without them, the fruit being eaten fresh, and also dried, in which case it is pounded and mixed with the flour of the coarser millets and pulses and made into kind of bread, sometimes the kernels are also pounded and added to the foregoing mixture. In the apricot season the roofs of all the houses are covered with the yellow fruit, spread out to dry in the sun. The oil is used for cooking, burning, and for the hair.

The fruit grown at high elevations—9,000 to 11,500 is small, inferior in taste, seldom ripens properly. Such is the case on the upper portions of the Chenab and Sutlej rivers and in Thibet.

Cashmir exports large quantities (about 200 mds.) annually of dried apricots into Ladak, and about half that quantity comes from Cabul, *via* Peshawar, into the Panjab every year. Balti also exports some to Lahoul where they are known as *pating*; they are sold at 4 *seers* 6 *chs.* per rupee.

The apricot is commonly cultivated between the rivers Indus and Sarda, in the N.-W. Himalaya, in the plains of the Panjab, Afghanistan, Western and Central Asia, China, and Europe. It is hardy in England.

It has been cultivated at Saugor, where it grows with amazing vigour when budded upon the peach-stock. It has been grown in Bengal and upon the Nilgiri Hills, but with limited success, as the fruit produced though answering tolerably well for preserving, never ripened sufficiently to be palateable, eaten uncooked. These facts though unpleasant for lovers of fruit, yet would not interfere very much with the oleaginous product, the principal object for cultivation. The apricot blossoms at the level of Poonah, but does not ripen fruit.

The chief drawbacks, at present, to obtaining a fair per centage on outlay are the want of a small stone breaking and sifting machine and portable oil presser; no doubt should a demand arise for such machines, some inventive genius will arise at the right moment and supply such requirements.

Botanical.—The apricot tree has been named *Prunus Armeniaca* by Linnæus; and is described by Roxburgh in his *Flora Indica*, II. 501. Its synonym is *Armeniaca vulgaris*, so named by Lamark; and described by Boissier in his *Flora Orientalis*, II. 652. It belongs to the natural order, *Rosaceæ*.

The Indian names are many, the chief ones being *Boorzha Cherkush*, *Cheroli*, *Chir*, *Chuli*, *Hari*, *Juldaru*, *Serkuji*, *Shari*, *Shiran*, *Zardaru*, in the Panjab Hills; *Zardaru*, in the Panjab Plains; *Iser* in Cashmir; *Chuli* in Ladak; *Mandata*, Trans-Indus; *Chuari*, *Zardalu*, in the N.-W.P., Himalayas. The dried fruit is known as *Khubani*.

Its professional description is as follows:—A moderate sized, deciduous tree. Nearly glabrous, petioles of young leaves pubescent. *Leaves* convolute in bud, broadly ovate, nearly as broad as long, accuminate crenate; petiole glandular, half the length of leaf; stipules lanceolate. *Flowers* pinkish white, solitary or fasculate, appearing before or with the leaves from scaly buds on the previous year's wood; peduncles generally short, included in buds. Calyx campanulate. *Fruit* a drupe, downy or smooth, with a tender, succulent, sapid pericarp, the stone, smooth, with a thickened sulcate margin. (*Brandis*).

SUNFLOWER,—(HELIANTHUS ANNUUS.)

OUR esteemed correspondent G. P. P. sends us the following memo. of an experimental cultivation of the sun-flower at Koteghur, near Simla, Punjab, Himalayas, in 1875-76. Elevation about 6,400 feet.

CULTIVATION.—The ground—fallow of previous season, two separate fields—was ploughed once; half of the ground was sown in furrows, half broadcast, result being about the same; thinned out, when about eighteen inches high treated as an ordinary field crop, at sowing time the seeds were mixed with an equal proportion of dry earth to distribute them more sparsely. Sown in March, reaped in October.

Soil fairly friable, tending to alumina rather than to silica; subsoil gravelly; drainage perfect.

Manufacture.—When ripe the heads were gathered, brought home in large baskets, and spread out in the sun, stirred about at frequent intervals, for a week to dry. They were then taken to the threshing floor, and beaten out by a couple of men, with long sticks, *i.e.*, flails; afterwards winnowed in the usual native manner. The seed (*Achænium*) thus cleaned, was then spread out in the sun for a few hours to dry, and afterwards partially crushed (*dulled* is the native term) in an ordinary handmill, in order to remove as much of the husk (*Pericarp*) as possible. It was again winnowed to separate the husk from the *albumen*, and then sent to the mill. It is necessary to husk the seed, or no oil will be obtained, as it will all be absorbed in the oil-cake. In the process of separating the husk from the *albumen*, 70 seers (140 lbs.) of seed gave 37½ seers (75 lbs.) of husk, and 32½ seers (65 lbs.) of *albumen*.

One man can husk, *i.e.*, partially crush (*dull*) and winnow one maund of seed per day.

Outturn of the two seasons—

6 seers 1¼ chittacks (12 lbs. 2½ ozs.) of seed yielded 70 seers (140 lbs.) nearly 12 fold.

70 seers (140 lbs.) of seed yielded 37½ seers (65 of *albumen*,) which gave, slightly over 10 quart beer bottles of oil.

With an improved oil-press, worked by bullock-power, a much larger yield would naturally result, though very much depends on the proper separation of the husk and *albumen*.

Expenses	Rs.	A.	P.
Ploughing and sowing, 12 pair bullocks ...	6	0	0
Thinning out, 6 coolies	0	12	0
Reaping and carrying to barn 28 coolies ...	3	8	0
Threshing and winnowing, 4 „ ...	0	8	0
Husking and winnowing, 2 „ ...	0	4	0
Pressing out the oil	0	12	0
Rs.	11	12	0

equal to Rs. 1-2-9 per quart beer bottle, or about Rs. 5 per gallon. The oil gave a very fine, clear, bright light. The oil-cake was greedily devoured by the cattle. The husk, mixed with barn or barley, was also eaten by the cattle. Some of the servants cooked their food with the oil and pronounced it delicious. The poultry liked the whole seeds. Bees are very fond of the flowerheads. It would appear that the sunflower requires a moderately moist climate with hot sun, and good deep rich soil, to enable it to be cultivated profitably. The areas of the fields have not been given, as that does not affect the question of outturn, which depends on the quantity of seed sown, and description of ground where cultivated.

ENGLAND'S FOOD SUPPLY.

The bread-stuffs imported into the United Kingdom—England of course mainly—last year were enormous. Let the reader look at the imports of wheat in the first place—

Wheat	1874	41,500,000 cwts.
	1875	51,800,000 „
	1876	44,400,000 „
	1877	54,200,000 „

Thus of wheat only, the imports were over 2,700,000 tons The imports of barley, oats, peas, beans, Indian corn (or maize) and wheat meal during the year, were—

Barley...	18,000,000 cwts.
Oats	12,900,000 „
Peas	1,500,000 „
Beans	4,600,000 „
Indian corn	30,500,000 „
Wheat meal and flour	7,400,000 „

Thus in addition to 2,700,000 tons of wheat and 370,000 tons of flour, or wheat meal, there were nearly 3,200,000 tons of other food-grains and pulse, imported:

Wheat	2,700,000 tons.
Wheat meal and flour	370,000 „
Other food-grains and pulse	3,200,000 „

Or an aggregate of 6,290,000 tons. But these figures, vast as they are, give but a very imperfect idea of the extent to which England has come to depend upon foreign countries, for her supply of food. Let the reader try to realise if he can, what the following figures mean. They represent in each case the imports of last year only—

Potatoes	8,000,000 cwts.
Butter	1,640,000 „
Cheese	1,050,000 „
Lard	600,000 „
Bacon and hams	2,800,010 „
Salt beef	210,000 „
Salt pork	300,000 „

Summarized more briefly, the imports were—

Potatoes	400,000 tons.
Butter, cheese and lard	200,000 „
Bacon and salt meat	160,000 „

To these vast imports, were added nearly (2,000,000) two million eggs *per day*, or an aggregate of 625 millions of eggs during the year. But we have not yet got anything like an adequate picture of the imports. In spite of the enormous pasture lands of the country, and the vast farming capital devoted to breeding stock, the imports of animals were as follows:—

Oxen and calves	205,000 head.
Sheep and lambs	894,000 „
Swine	20,000 „
Meat, salted and fresh	1,280,000 cwts.

Even these figures still give a very imperfect idea of the extent, to which the country depends upon sea-borne commerce for its food. We have said nothing of the almost incredible quantities of fish, poultry, vegetables, and fruits that pour daily into every harbour in the country from foreign ports; nor anything of the vast supplies of sugar, tea, coffee, wines, dried fruits, and the thousand luxuries to which her high standard of living has accustomed England.

EDITORIAL NOTES.

While demanding tenant right for the ryot in the interest of the entire Commonwealth, we would not have the zemindar suppose that we are insensible to the fact that his difficulties are often very great from the ill conduct of his tenantry. We have no doubt whatever, that the ryot is but too frequently the aggressor in the agrarian disputes in Bengal, particularly in its Eastern districts. Upon the slightest provocation, and often upon no provocation at all, the ryots will combine not to pay the rents due by them to the zemindar. We cannot but think that exemplary punishment might be very wholesomely inflicted in such cases. Let it be clearly shown, that a body of ryots have combined causelessly to withhold from the zemindar his just rentals, and the leaders should be sharply punished. The ryots of the Eastern districts bear an unfavourable character, and while we must do all we can to secure tenant-right for them, there should be prompt suppression of lawless combinations amongst them.

The weight of goods carried over the Eastern Bengal Railway during the four weeks ending 25th May amounted to maunds 607,203, which, as compared with the traffic during the corresponding period of 1877, shows a decrease of maunds 128,263. This decrease is mainly in grains (including rice) and seeds. The increases are chiefly cotton, gunny, drums of jute, piece-goods, salt, tea, tobacco, turmeric, and miscellaneous articles.

We observe from Mr. Duthie's report on the Botanical Gardens of the N.-W. P. that considerable quantities of Hyoscyamus, (atees tuber) Kamaila powder and oak bark, have been supplied to the Medical Department by the gardens. This is a step in the right direction. Our hills could grow and supply nearly all the medicinal plants, for which we have now to indent on Europe.

It has been determined by the officers of the Punjab Forest Department to avail themselves as much as possible of the provisions of the New Forest Act, with a view to the preservation of game. A commencement has been made with the Chunga Manga plantation, which will be strictly observed during the close season, and care will be taken that no poaching or netting takes place during the shooting season, that is, between the months of October and March. All true sportsmen will welcome this step, and regard it as one taken in the right direction.

Official returns show that the reduction of four annas per maund in the duty on salt, has caused an enormous increase in its consumption through Northern India. Taking the Northern Punjab Railway alone, the traffic has grown ten-fold; in April 1877, only 9,159 maunds were sent from Jhelum and Gujerat; while in the same month of 1878, 94,575 maunds were carried. There can be little doubt that hitherto the supply of salt has been limited, simply by *the poverty of the people.*

We are sorry to learn from our *Bangalore* contemporary, that owing to want of sufficient support, the Mysore Agri-Horticultural Society is languishing, and that ere long it may be numbered among the things of the past. This is much to be regretted, as the society has in its power the means of introducing new kinds of vegetables, plants, &c., and has done very much to encourage the improvement of all kinds of indigenous fruits and vegetables. The society depends on subscriptions from members who have fallen away a good deal lately.

A CORRESPONDENT writes to us from the Dhoon :—

"I have rented out land to ryots, on the plan of my getting one-third of the crop as rent, and from the *rubbee* crop just gathered, I have got 2 maunds 17 seers as my share from 20 bigahs. This shows what the outturn of the harvest has been."

The North-West bigah is less than one-fifth of an acre (0·19) so that twenty bigahs are about 3·81 acres ; the total yield therefore was

2 maunds 17 seers X 3 = 7 maunds 11 seers.

As the maund is 82lbs., we have a gross produce of 596lbs. for nearly four acres. Does our correspondent really mean, that the harvest of wheat this *rubbee* in the Dhoon, has been but about 150lbs. = 2½ bushels per acre ? The fact is nearly incredible, and we should be obliged to him, if he would confirm it. The poorest wheat soils of India yield from 6 to 8 bushels per acre, while the virgin soil of the Dhoon should yield 30. Was it the failure of the rains last monsoon that destroyed the crop ?

OUR friend G. P. P. writes to us regarding the sun-flower :—Are you aware that its seeds when *torrified* (*i. e.*, roasted) in the same way as the seeds of coffee, make an agreeable drink, which may be used as a substitute for that article. The *liber* (*i. e.*, fibrous inner bark) of the stem is composed of a very tough woody tissue, which may be manufactured into *twine* and *cordage*, and *a very good paper* may also be made from the same tissue. The pith is almost entirely composed of the vegetable principle, called *medullin*, and has been used in Russia for the manufacture of *moxas* (used in paralysis) and other medicinal purposes.

IN the account given in our leading columns of an experimental cultivation of the sunflower at Koteghur, it will be observed that in estimating the cost of oil, it has been omitted to subtract from the cost, the value of the oilcake as cattle-food, and the value of the stems as fuel ; the cost of the oil per gallon will therefore be less than Rs. 5.

WE draw the attention of our readers to an article on "*Apricot Cultivation*," found elsewhere. The cultivation of this fruit will commend itself as profitable to many planters in Northern India.

Mr. Caird is reported by the *Times* to have said :—

Though he often heard India spoken of as a poor country, the broad fact that she maintained to the square mile a population greater than that of either France or Germany, both of which had other important industries besides agriculture, seemed to show either that her soil was unusually rich, or her agriculture by no means so defective as was generally represented. There was, indeed, no plant of value which could not be produced in India, and in this country we during the last three unproductive years, had experienced the advantage of her agriculture both in the direct supplies and the consequent check to the rise of price, though the increasing quantities of wheat she had been able to send to us, and which in 1877 reached one-ninth of our total foreign imports. With fertile soil, an abundant supply of labour, extensive railway communication on all the main lines of travel, and vast works of irrigation already executed, India under good Government and with time must prosper. If he should have the good fortune to return from India he might be able to speak from personal knowledge of the subject, one of which, as member of the Famine Commission, it would be his duty to investigate. That the elements of prosperity were there was unquestionable, and this country had undertaken a responsibility for their proper use which could not either with safety or honor, be neglected.

MESSRS COLLINS & Co, a large American firm of agricultural implement manufacturers, write to us from New York : "We have perused some of the late numbers of your journal with great interest, as the crops and modes of cultivation are so different from those in our own country.

"We read the report of Mr. Harman published, in the *Agriculturist* of February 1st, and it seems to us that the very light steel ploughs, such as we produce would work very satisfactorily with the "miserably fed and stunted beasts" as compared with the heavier English-made ploughs. We are quite familiar with the models and sizes of most English ploughs, and we have never noticed any that can approach American ploughs for lightness combined with efficiency. For example the very smallest plough presented by the Messrs. Howard of Bedford, called "dwarf plough" is made "for a very small horse (one) and yet it weighs, 140 lbs. Our ploughs cutting 9 *inches* wide, weigh *less than* 50lbs. and are easily drawn by one animal. We should like very much to have our ploughs tested by Mr. Harman, or by some other experienced agriculturist in comparison with any others, and it will give us pleasure to send WITHOUT CHARGE, specimens of them, if Government will accept them, test them, and report to us *how* they WORK."

This is a very generous offer and we shall be happy to forward applications for these ploughs from any Superintendent of Government farms, who is disposed to give them a trial.

The 50 lbs. plough, cutting nine inches, seems to be light enough for our cattle. One of the great wants of the Indian agriculturist is a plough, suitable to the soil and cattle of the country, and to obtain it, we have even advocated that a large competitive prize should be offered by Government.

THE Government of the Central Provinces, in acknowledging the annual report of the Agri-Horticultural Society of Nagpore, points out that the agricultural public loses greatly by the results of experimental and other operations in public gardens not being made known and the Chief Commissioner considers it advisable to have reports on the working of the public gardens submitted to the Secretary Agri-Horticultural Society. He suggests that that officer might notice their results in his annual report, and any interesting portions might be extracted and published as appendices to it. This would tend to bring district officers into closer connection with the Society, and induce them to take advantage of the facility it affords for carrying out the objects for which public gardens are mainly intended.

IN the *Gazette of India* the Governor-General in Council invites tenders for the lease of the Great Coco Island in the Bay of Bengal. The lease will be for a period, not exceeding 20 years. In addition to the rent payable to Government, the lessee will be bound to defray the expense of maintaining peace in the island and on its coasts, and of the administration of civil and criminal justice. The Government fixes a maximum of Rs. 20,000 annually for such expenditure. But the administration of civil and criminal justice, customs, excise, and other departments will be retained at the hands of Government. The rent will be taken in kind. Tenders may be received from persons resident in India or the United Kingdom. Other conditions are annexed, for which we refer our readers to the resolution.

THE Madras Government has for some time been inquiring into the practicability of growing the *Musa textililis*, or Manilla hemp, in that presidency for manufacture. In the Philippine Islands, where it is largely produced, it can hardly be said to be cultivated. Much of it grows entirely wild, and where it is nominally cultivated, the cultivation consists of sticking the young plants into the soil, and letting them grow till the beginning of fructification. The manufacturing process is altogether by hand, the cost of labour alone being half the value of the fibre produced. The plant grows freely in Madras wherever it can be freely irrigated, but as the irrigable lands are already under profitable culture, the important question is—in what localities it may be produced without artificial irrigation. Mr. Robertson, Superintendent of Government farms, the great agricultural authority of Southern India, is of opinion that such localities are confined to the Western Coast, and the slopes of some of the higher hill ranges. Its requirements in the way of soil and climatic conditions, are similar to those of the common plantain. Mr. Robertson estimates that the stems could be produced at a cost of from Rs. 2 to Rs. 3 per ton, but considering that it grows wild in the Philippine Islands, he seems to have a doubt whether it could be manufactured in Madras, at a cost which would enable it to compete successfully with the produce of the Philippines. Clearly this can only be done by means of machinery, which, by decreasing the cost of labour might perhaps more than compensate for the greater cost of production. Accordingly, the question of machinery is now under investigation, and in the meantime Mr. Robertson recommends that experiments should be made to ascertain with a greater degree of accuracy, the cost at which the stems can be produced per ton.

MISCELLANEOUS NOTES.

DR. DAY is at present engaged on another work on "The Fishes of India." In fulfilment of his engagement with the Government of India, the work was to have been completed by the end of the present year, but owing to Dr. Day's illness, and to difficulties connected with the illustrations, it will not be issued till later.

WE observe that the Collector of Malabar, through the District *Gazette*, is inviting people of enterprise to go in for cocoa cultivation. The plant thrives, we are told, in many parts of the district, and about a hundred acres of land are already under cocoa. We may mention, for the information of gentlemen who have not yet made their fortunes, that many thousands of acres of suitable land are available on the Periah Ghats in Kottayam.

THE Annual Report on the Land Revenue administration of the Central Provinces for the year ending 30th September 1877, is considered on the whole as indicative of satisfactory progress. The revenue demand when compared with that of the preceding year, presents the following return :—

1875-76	...	.... Rs. 61,35,105
1876-77	...	... „ 61,94,699
Thus showing an increase of		„ 59,584

The crops were generally good throughout the year, but the famine in Madras and Bombay, and the large demand for wheat and oil seeds for exportation to Europe raised prices to a height which began to press upon the poor of the non-agricultural classes; which pressure was however removed towards the close of the year, by an opportune fall of rain which checked the famine demand. It is remarked as a favorable circumstance in connection with the revenue administration of the year, that cattle disease was much less prevalent than in 1875-76.

"ARISTARCHUS" in the *Whitehall Review* writes :—The Agricultural Exhibition in London next year bids fair to be a success. An admirable site of 100 acres in extent—well drained and easy of access from all parts of London—has been selected by the Royal Agricultural Society, subject only to the formal assent of the Ecclesiastical Commissioners, who are the freeholders. The place chosen is within two miles of the Marble arch, in the neighbourhood of Kilburn of Brondesbury. The Prince of Wales has accepted the presidency of the Royal Agricultural Society for the year, and the coming Lord Mayor—Alderman Sir Charles Whetham—is the chairman of the Mansion House Committee, by whom the necessary guarantee fund is being raised. About £15,000 or £20,000 is required, and I am glad to learn that, headed by the generous contribution of 100 guineas from the Queen the list at the Mansion House, even at this early period, exceeds £3,000. Mr Soulsby, the Lord Mayor's secretary, will be glad to give any information, or to receive any donations towards the carrying out of this project."

INDIAN weather and its indications are at last to be treated scientifically. Mr. John Elliot, the Chief Meteorological Reporter to the Government of India, has left Simla for Calcutta, to make the necessary arrangements for systematically recording atmospheric phenomena, and to organize a small staff of weather-clerks, who will shortly return with him to Simla. For the next four months, we are told, reports will be telegraphed thither daily, from some fifty observing stations in every part of India—from Peshawar to Colombo and from Kurrachee to Rangoon—and the information thus sent will be manipulated in a scientific manner, and made public through the Press.

WITH reference to the famine articles which are appearing in the Calcutta *Statesman*, a correspondent of that paper writes :—I think you are touching on very important points. I don't think sufficient attention has been paid to the great increase of population, since, the time of native rule. I heard from one of our most experienced native Revenue officers, a few days ago, the suggestion that our assessment was too low, and that as the people could with a little scratching of the soil get enough produce to pay their assessments and feed themselves, they were careless and did not cultivate as they might, or as well as they do in native States, where the rate of assessment is much higher—twice or thrice what our is. What think you of this? And also that the assessment does not amount to more than 15 to 20 per cent. of a ryot's yearly expenditure. I am trying to get the latter statement verified. The Editor appends the following note :—

> We have ever held that the assessments of late years are unduly low. They at once demoralize the cultivator, and form the sowcar's opportunity. Every inch the State recedes, the bunniah moves forward. It is our unduly low assessments, that make the possession of land so coveted by the sowcar. Fairly high assessments (or rentals) and prompt suspensions and remissions when the harvests fail, are far more suited to the character of the people, than our very low assessments and rigid exaction of the demand, under all circumstances."

WE are sorry to see the testimony of a Catholic missionary in the Soonderbunds to the fact, that the land is passing from the hands of the ryot into those of the zemindars :—

> "The people are generally very poor; a great number pass their lives in continued distress, and half the year in something very akin to starvation. The property of the land is passing into the hands of the zemindars; and what was formerly cultivated as 'mal,' *i.e.* property of the cultivator, under a reasonable rent of something like one rupee per beegah, has to be cultivated now as 'ticca,' under a rent which is simply ruinous. In fact, after my five years' experience of the country, living as I do in the midst of the people, acquainted with their every-day doings, I cannot well conceive what profit there may be in cultivating paddy-fields burdened with a rent of from 3 to 4, sometimes 5 rupees per beegah, the average outturn of which is from 6 to 10 'kowris' of rice, which in ordinary times will not realise above so many rupees, and the cost of cultivation being at the very least two-half rupees, without taking into account the cost of harvesting and storing."

This process of permitting the land to pass from the cultivator into the hands of a non-cultivating class, ought to be stopped at all hazards and at any cost. Many years ago, the whole subject was fully discussed in the columns of the *Indian Economist*. By permitting the transfer of ownership from the cultivator to the *mahajun*, or zemindar, we are simply paving the way to the total pauperization of the former, and the reduction of them to a cottier tenantry, living on the very verge of famine from one decade to another.

THE same writer says :—

> "Most of the people live, I may say, on borrowing; and as the usual interest is 50 per cent. on paddy (for six months), and 2 to 4 pice on the rupee per month, it is evident that the little the Bengali peasant may contrive to earn by his work, must go to the 'usurer.' The misery entailed by this merciless system of usury is unspeakable. Other causes of distress are the more or less chronic failure of the crops, the frequency of diseases, and perhaps more than any thing else, the extravagant expenses attending marriages. Very seldom is a marriage celebrated without some part or the whole of the family property being mortgaged to the usurers. I have not spoken of the exactions of the zemindar and his agent. Although these exactions are illegal, and one might say that the remedy lies in the hands of the ryot, since recourse to justice is open to all, yet in reality there is no remedy for it in the actual circumstances of the country. It is a well-known axiom here that 'money will do everything,' and of course so long as this is the case, it is simply ruin for a ryot to attempt litigation with his landlord."

There *is* a remedy for it, and it must be found.

COMMUNICATED AND SELECTED.

GOVERNMENTAL EXPERIMENTAL FARMS.

REPORT OF THE KHANDESH FARM FOR MAY 1878.

Superintendent—Mr. A. Stormont.

Weather.

SEVERAL showers have fallen during the month, one (on the 17th) measuring so much as 8 cents; it was preceded by a violent wind storm which did considerable damage by breaking down, and in some cases uprooting trees.

Prospects.

2. As usual the cultivating community are expecting an early monsoon, for little better reason perhaps than that such is their wish. Contrary to all apprehensions the drinking water supply has stood out well and people are now mostly in good spirits.

Securing the corn crop.

3. On the farm, general work has been mostly set aside in favour of threshing out the remainder of the grain crop, and the storing of fodder indoors for use during the early part of the rains.

NEW PLOUGHS.

American ploughs.

4. Three new ploughs lately presented to the farm by Messrs. Ransomes, Sims and Head of Ipswich have been under trial. Two of them are merely improvements on the South American mule plough. They are capable of being unscrewed in a few minutes and so packed up that a man may carry the whole thing under his arm.

Less effective than the country plough.

This plough works well enough in free soil, especially with mule draught for which it is designed. It is much less effective, however, than a well-made native plough when applied to ordinary black land. Thus it was proved by experiment that one pair of bullocks comfortably dragged the wooden plough in a 10-inch furrow, whereas to work the same depth with the iron or moulding plough two pairs of bullocks were fully draughted. Besides the labour of *holding* the plough under such conditions is too severe a strain for the strength of the Indian cultivator.

Combined Indian plough.

5. The other plough is quite a new invention of Messrs. Ransomes, Sims and Head; it is appropriately called the "Indian plough," the principle of which it follows throughout, differing however to the extent of being constructed of combined iron and wood and having the share running up into a curved plate which acts slightly as a moulding board.

6. This plough works very creditably indeed, and would fairly well suit all the requirements of the cultivator. As matters at present stand, however, there are two obstacles to its very general adoption: 1*st*, the expense of *iron* work, and 2*nd*, the cheapness of *wood* work in the agricultural districts of India.

FODDER PLANTS.

"Teosmite Plant."

7. A sowing of the new fodder plant, *Reana luxurians*, has just been made under well irrigation, but the crop has not yet come up. If it turns out to possess in India but half the good qualities claimed for it in Guatemala, Réunion, and the French Colonies of Africa and America, then it will be an invaluable fodder plant for India.

Prickley Comfrey.

8. Prickley Comfrey continues to yield disappointing results, a bad feature being that the roots are very liable to die off should the supply of water happen to fail.

Seeds.

9. Now that the sowing season is approaching, there is great demand for the farm selected seed, especially of wheat, indigo, and gram, which are now being distributed.

Cattle food.

10. Fodder and feed stuffs are cheapening, it being now apparent that the supply in the district will be equal to all possible requirements.

SALAROO (SIND).

Superintendent, W. Strachan.

As the arrangements to be conducted on the farm during the current year have not yet been decided, I shall in the present report confine my remarks to the garden chiefly.

Sorghum saccharatum and brown-seeded jowari early sowing.

An acre of the farm land, half with *sorghum* and half with brown-seeded jowari, was sown between the 9th and 18th January 1878. Though the weather was cold, the *sorghum* came up freely and has grown fairly well. The jowari had to be resown and has still come up too thin. A similar area was sown in the same proportion for feeding the garden cattle and with (as yet) similar results. The *sorghum* seems to stand heat quite as well as, and cold much better than, does jowari.

Grape vines.

We have in the garden in full fruiting order some twelve varieties of English vines, all of which do well, and produce fruit far superior to that obtained from any of the native varieties. The black Hamburgh variety does not colour well, but the flavour is good. With the view of trying to improve the colour, a liberal supply of charcoal was dug into the borders last year and this spring. The Muscat varieties do very well, and I believe there would be no great difficulty in starting a trade in raisins of no mean quality. Last season in drying some of the best Muscat grapes for seed, I had about half a pound of raisins of quite as good flavour and appearance as any Muscatels I have seen for sale. The natives are going in strong for vine culture in this neighbourhood, and our supply of young plants has not yet been equal to the demand, and from the number of new gardens springing up all round, there is little likelihood of the number of indents on our nursery stock falling off for some time to come.

Pomelos, orange and lemon.

Varieties of these have been introduced from Bombay and Lahore, and are being propagated for distribution as fast as possible. The orange grows fast and produces excellent fruit here. We have not been able to supply all demands for young plants, nor will we be so for another year or two. The stocks used for budding on are the citron and sweet lime, both of which do well here. Fruiting plants of all sorts are in much demand among the natives, and care is taken to give nothing likely to disappoint them, without informing them that success is doubtful beforehand.

Prosopis glandulosa or Mesquit bean.

The seed received from Government last year came up well and a number of plants have been distributed. The tap root goes deep into the soil,—a great desideratum in a plant growing in an almost rainless country and with the natural water spring far below the surface (at Salaru we have to dig 28 to 30 feet before we strike water.)

Ceratonia siliqua (Carob.)

Of this, we have a large number of healthy seedlings on hand and several have been given away. We have one plant fully five years old. It is of slow growth, being only 8½ feet high at present.

Böhmeria nivea.

Grows well in the garden where it is sheltered from the hot winds of May and June, but refuses to grow on the exposed fields of the farm during these months. Success with it is very doubtful.

Eucalpyti.

Several varieties of seed were received from the Brisbane Acclimatization Society and sown about the end of last year and first month of the current season. All are as yet doing well, but it is too early to say much about them at present.

Coffee.

The seedlings have just got above ground and look healthy.

India-rubber tree or *Ficus elastica.*

Grows fast, a good shade tree; has been largely propagated and distributed.

Cedrela toona (Toon).

Grows fairly well here and has been propagated from seeds and cuttings from the trees growing in the garden. It is not a favourite with the natives, but may be a useful tree in Sind, if pains be taken to follow up the experiment of its introduction.

Flowers and vegetables, foreign and native, receive a certain amount of attention, but with the exception of roses (of which we have pretty near 200 varieties) and scented plants, the natives do not indent on us much for either seeds or plants of these.

Jerusalem Artichoke, *Helianthus tuberosus.*

A small plantation has lately been made.

REPORT ON SALARU FARM, DATED 14TH MAY 1878.

Supdt., Mr. W. Strachan.

ON the farm we have sown for cattle feed an additional 3 acres 8 *guntas* of jowari which is coming on well, a little over one acre of Sind native cotton has been sown on land which last year yielded a crop of bajri. This land has been well manured with farm-yard manure, ploughed and sown in the ordinary native way.

The sorgho and jowari referred to in last report, are both doing well, and are being preserved for seed. The sorgho is still ahead of the jowari, and will be ready for harvesting within ten days.

2. A detailed account of last year's experiments is being prepared and will be ready for submission in a few days, meanwhile I may mention that the outturn of clean cotton per acre on an area of 15½ acres is very near 315lbs., the outturn of clean staple to seed being 33·7 per cent. The two acres sown on well land, between 19th March and 28th May, gave an average yield of 362 lbs. clean cotton. This is a poor return for an early sown field of Sind cotton, and is to be attributed to the failure of the last season's inundation. None of the crops got sufficient water. The value of the cotton barely clears the cost of production in this case.

3. *Tobacco* turned out pretty well. The area planted was 20 *guntas*, the yield of leaf 1,354½lbs., the cost of production is Rs. 59 10-7, the amount realized by sale of the crop Rs. 124-8, leaving a profit of Rs. 64 13 5 on the proceeds of the half acre. Tobacco has been grown for several successive years on the same plot of land, and since the first season to the present, the quality and value obtained for the leaf has yearly improved. The land is a light, sandy alluvial deposit; all refuse of each year's crop, such as stems and roots, are collected into small heaps, burnt and ploughed in, along with a good dose of goat and sheep droppings. It gets a cross ploughing, is pulverized, levelled, and ridged as if for turnips, and is then ready for watering, previous to the young seedlings put in.

4. *Lucerne* was a failure, the ground seems to be deficient of some ingredient required for its full development. The stems were, and are now thin and weak, barely able to support themselves. I believe a little time might improve matters.

5. All the plants referred to in my last report are doing well. Grapes are swelling fast, some of them are now of good size.

The different varieties of *eucalypti* in pots are healtheir than I have hitherto seen here any of the same family at this season of the year. Coffee is also thriving, it is as yet in the seed pans.

A considerable quantity of *casuarina muricata* seedlings have come up from seed, saved last year from plants in the garden. The same remark is applicable to our progress with *gmelina arborea*, which as yet thrives well here.

CROPPING AND ROTATION.

THE question of rotation of cropping and manuring has been touched upon in my letters repeatedly, but to endeavour to make the matter more distinct, I shall begin at the beginning, and work my way from the formation of soils, to their exhaustion by cropping, and their renovation.

Geologists hold, and probably correctly, that the first origin, countless ages ago, of all soil, was the decay of rocks. The decay has been effected in these long cycles of time by causes still in operation, as may be seen in the crumbling of stones, and the "weathering" which appears on the hardest rocks when exposed to the weather, especially in climates subject to extremes of temperature, and heavy rains. During certain epochs our planet has undergone great changes in its conditions of cold, heat, and moisture, all tending to the decay of the surface of rocks. Rain, or dew, or any form of moisture, dissolves a chemical quality in the atmosphere, called carbon dioxide, and brings it in contact with rocks, and the action of this is slow, but irresistible, during long periods of time, and disintegrates the surface of the hardest rocks. Frost,—and probably there is no part of the world but has passed through a glacial period,—is a mighty agent in decomposing rocks. A slight superficial layer of decayed rock being produced, vegetation begins to help the process. Lichens, and by and bye mosses, begin to grow on the exposed surfaces, increase the moisture, accumulate decayed vegetable matters or humus, and this again increases the carbon dioxide, rendering the rain penetrating to the rock still more powerful in its dissolving and distintegrating action. Trickling water soon gaining volume as rushing streams, and torrents, wear deep fissures in the rocky hills, glaciers grind the face of the rocks into impalpable powder, and these *debris* are deposited as soil, when the streams are no longer so rapid as to carry them in solution. The great plains, such as that of the Ganges in Bengal have all been formed by the rivers depositing what they have washed down from the higher lands along their course. The lava from volcanoes crumbles into a fertile clay, and the fruitful fields for miles round Edinburgh are upon ancient beds of lava. Decaying vegetation adds to the soil of which it is an important part, and in wet climates, the growing peat mosses are notable examples of this. Soils of purely mineral origin would be comparatively barren, and those of nearly purely vegetable components, are much the better for an addition of mineral constituents.

Certain classes of rock, such as limestone, are known by their decay or disintegration to produce soils of greater fertility than others, and if all soils were the natural product of the rocks which they cover, a knowledge of the climate and geology of a district would be all that is necessary to judge of its fertility. A large proportion of the soil in Britain, and probably in most other countries, still lie upon their parent rock, but there are also large tracts from which the original soil has been removed by water, and another substituted by the same agent, or the original soil has been carried with a deep stratum, perhaps from a great distance. All through the south of Scotland and north of England, we find deep strata of a stiff red clay technically called "till" full of waterworn stones, which is supposed to have been scooped out of the bed of the Baltic, and deposited where it lies by the sea, before it was upheaved into dry land. Decaying vegetation, and the action of the atmosphere have produced a mixed vegetable humus on the surface of this stubborn glebe. The deep deposits on the plains of Bengal completely hide what may have been the original covering of the rocks. Some geological formations produce inferior soils, and there are others full of the materials of vegetable life, but close, cohesive, and difficult to work. All soils are chiefly composed of five main ingredients, sands, clay, lime, vegetable-matter, and mineral fragments in the shape of stones, and on their proportions depends to a great degree their fruitfulness. The sub-soil, or that portion of the earth, immediately below the section cultivated, also materially affects the productiveness of the cultivated surface. The sub-soil may be too open with sand or gravel, draining off the moisture too rapidly, thus making the crops subject to drought, besides allowing the manures to be washed away before being assimilated by the crops. I know many instances of these deceptive lands, where the surface looks all that can be desired, but which require continual manuring to keep them productive. On such lands manure should be applied little and often, and as near the sowing of the crops as possible. A tenacious clay sub-soil is better than this hungry one, as it can be improved by draining, while the former cannot be improved by any known means.

The reverse of the open sub-soil is the tenacious clay, or a "pan" of hard deposit either of salts of iron, which is common enough on our moorlands, or of calcareous matter, the latter sometimes occurring in lime-stone districts. These are all fatal to profitable cultivation in their natural state, as they retain the water in a stagnant state till removed by evaporation, prevent the air penetrating through the soil, and the roots from going down in search of food. The "pans" should be broken up, and the stiff sub-soil drained, to allow the rains, charged with fertilizing gases from the atmosphere, to pass through it. More rain passes through a drained soil than through an undrained one, as, if the earth is already full of water, the rain must run off the surface, carrying manure or soil with it, for every drop of muddy water carries some soil with it, or stands till it is evaporated. The celebrated Baron Leibig says "It is well known that stagnant water is injurious to plants, and the favourable effect produced by draining just depends on this, that an outlet is opened to the water moving by its own gravity, and the earth is moistened by that water only which is retained by capillary attraction. The narrow capillary spaces should be filled by water, and the wider by air, so that the roots of the plants are encouraged to penetrate deep in search of food" Schubert caused an excavation to be made in a deeply drained clay, and a stream of water was directed against the upright wall left, so that the roots of the plant were laid bare. The exposed roots presented the appearance of a mat or felt of white fibres, to a depth of four feet from the surface. Now if the sub-soil had been soured by stagnant water these roots would have been repelled, and seeking their food along the surface, would have been more easily droughted. It is plain also that in time these roots would die and decay in the sub-soil, thus improving its capabilities for the support of plant life. On high lands and late climates crops ripen earlier on drained than on undrained land. When water remains in the land till it is evaporated, the temperature of the soil is materially lowered. Mr. Josiah Parkes, a well known draining engineer found that the temperature of an undrained portion of a bog was 46 degrees from one foot deep down to thirty feet, and on the drained portion he found the soil was of a temperature of 48 degrees three feet from the surface. I have previously described the process and materials for drainage, and need not again go over them.

The porosity of soils has a very important bearing on their fertility, and ability to support vegetable life in extremes of wet and drought. The mass of a soil may be described as a hunting ground in which the roots search for food either liquid or solid. The texture of a soil must be firm, yet open, so as both to protect the tender roots, and to allow them free passage. The best friable soils, full of vegetable humus, are naturally easily penetrated by roots, allow a free passage to water, and yet retain moisture from capillary attraction. Stiff clays, and sand are different. Sand of itself does not retain water, and moisture rises from the bottom to a very limited height in it by capillary attraction, so that it is easily affected by drought. The only way of effecting much improvement is by covering it with clay, and thus changing its character. Clay soils require great care in cultivation, as, when ploughed in a wet state, they run into lumps, impenetrable by roots, and are unfit for raising water for the supply of plant life by capillary attraction. Moisture below will flow up finely pulverised loamy soils from a depth of 36 inches, while it will not rise in cloddy clays more than 5 or 6 inches. This shows the necessity of finely pulverizing and deeply cultivating these soils in all climates subject to droughts. They should be ploughed for the ensuing crop as soon as the removal of the previous one, and the climate will permit. If the surface should get stiff they should not again be turned over, thus stimulating evaporation, and bringing intractable lumps to the surface, but should be gone over by a grubber, which loosens, but does not turn up the soil. A grubber is a frame, carried on wheels, with five or seven tines of teeth depending from it, which penetrate to a depth of five or six inches. The teeth have a curve, and root weeds are brought to the top without being cut or broken, as they are by the plough. A grubber suitable for general use costs from 70 to 80 rupees in this country. The other pulverisers are rollers, which should be used as little as possible on stiff soils, common-toothed harrows, now generally made entirely of iron, and the chain harrow. The latter is a most valuable implement for general use, breaking clods, smoothing the surface, and gathering weeds better than almost any other, with a light draught. It costs here from Rs. 40 to 50.

Where there are small stones in clay soils, they should not be gathered off without caution, as they keep the soil open, and I have seen land materially injured, and made much stiffer and worse to work by the stones being perseveringly gathered off it. These rolling stones gradually decay from their exposure, and no doubt help to keep a supply of minerals.

Of the five principal ingredients, I have named as originally in all soils, plants extract very little except the lime, and in my next I will endeavour to show what, according to the latest scientific authorities, they do extract, how it is supplied, exhausted by crops, and again replaced for future vegetation.—*Correspondent Madras Mail.*

ACTION OF LIME ON SOILS.

REGARDING the action of lime on soils, Liebig writes as follows in his letters on Chemistry (letter No. 32):—

"Some soils abound so much in readily decomposable silicates that after every one or two years as much silicate of potash has become soluble and fitted for assimilation as is required by the leaves and straw of a crop of wheat. In Hungary, extensive districts are not uncommon where wheat and tobacco have been grown alternately upon the same soil for centuries, the land never receiving back any of those mineral elements which were withdrawn in the grain and leaves. On the other hand, there are fields in which the necessary amount of soluble silicate of potash for a single crop of wheat is not separated from the insoluble masses in the soil in less than two, three, or even more years.

"The term *fallow*, in agriculture, designates that period in which the soil, left to the influence of the atmosphere, becomes enriched with those soluble mineral constituents. *Fallow*, however, does not generally imply an entire cessation of cultivation, but only an interval in the growth of the cerealia. That store of soluble silicates and alkalies which is the principal condition of their success is obtained if potatoes or turnips are grown upon the same fields in the intermediate periods, since these crops do not abstract a particle of silica, and, therefore, leave the field equally fertile for the following crop of wheat.

"The preceding remarks will render it obvious to you that the mechanical working of the soil is the simplest and cheapest method of rendering the elements of nutrition contained in it accessible to plants.

"But it may be asked:—'Are there not other means of decomposing the soil besides its mechanical subdivision? Are there not substances which, by their chemical operation, will equally well, or better, render its constituents suitable for entering into vegetable organisms?' Yes, we certainly possess such substances, and one in them, namely, quicklime, has been employed for a century past in England for this purpose; and it would be difficult to find a substance better adapted to this service, as it is simple, and in almost all localities cheap and easily accessible.

"In order to obtain correct views respecting the effect of quicklime on the soil, let me remind you of the first process, employed by the chemist when he is desirous of analysing a mineral, and for this purpose wishes to bring its elements into a soluble state. Let the mineral to be examined be, for instance, felspar, this substance, taken alone, even when reduced to the finest powder, requires for its solution to be treated with an acid for weeks and months; but if we first mix it with quicklime, and expose the mixture to a moderately strong heat, the lime enters into chemical combination with certain elements of the felspar, and its alkali (potash) is set free. And now the acid, even without heat, dissolves not only the lime, but also much of the *silica* of the felspar as to form a transparent jelly. The same effect which the lime in this process, with the aid of heat, exerts on the felspar, it produces when it is mixed with the alkaline argillaceous silicates, and they are for a long time kept together in a moist state.

"Common potter's clay, or pipe clay diffused through water, and added to milk of lime, thickens immediately for mixing; and if the mixture be kept for some months, and then treated with acid, the clay becomes gelatinous, which would not occur without admixture of the lime. The lime, in combining with the elements of the clay, renders it soluble; and what is more remarkable, liberates the greater part of its alkalies. These interesting facts were first observed by Fuchs at Munich; they have not only led to a more intimate knowledge of the nature and properties of the hydraulic cements, but, what is more important, they explain the effects of caustic lime upon the soil, and guide the agriculturist in the application of an invaluable means of rendering it soluble, and setting free its alkalies,—substances so important, nay so indispensable to his crops.

"In the month of October the fields, of Yorkshire and Herefordshire look as if they were covered with snow. Whole square miles are seen whitened over with quick lime, which, during the moist winter months, exercises it beneficial influence upon the stiff clay soil of those countries.

"According to the now abandoned humus theory, quicklime ought to exert the most noxious influence upon the soil, because all organic matters contained in it are destroyed by lime, and rendered incapable of yielding their humus to a new vegetation. The facts are indeed directly contrary to this now abandoned theory; the fertility of the soil for the cerealia is increased by the lime. The cerealia require the alkalies and soluble silicates, which the action of the lime renders fit for the assimilation of the plants."

WILD PLANTS AS FAMINE FOOD.

At the request of the Madras Government, Surgeon-Major J. Shortt prepared a list of most of the wild plants, their roots, leaves, fruits or seeds that are eaten by the poor during seasons of drought and famine. In forwarding this list to Government Dr. Shortt says:—

"I commenced the collection first during a visit to Ganjam in 1870, and have to thank G. H. Ellis, Esq., and J. G. Thompson, Esq., the then Collector and Judge of that district, who kindly at my request procured for me several specimens for identification. Since that I have been adding to the number, and during a tour the Bellary, Kurnool, and Cuddapah districts in December 1876, at the onset of the present famine, and in the North-Arcot and Salem districts, during 1877, I collected further information. The list is alphabetically arranged; many of the leaves and young shoots of those used as greens are much more frequently used as *Calavay Keeray* or mixed greens. This is a favourite mode of using them at all seasons, and they are in great repute even among well-to-do people. Women collect the wild greens both as an amusement and occupation, adding at the same time an additional dish to the family. Many European and East Indian families are partial to them, as they are said to be healthy, and to have a slight laxative action to the bowels, that they will frequently send their female servants out to collect them. The tender pith and leaf-bud of the Hedge Aloe is only eaten by the poor from great pressure of hunger, as it is unwholesome and causes dysentery and diarrhœa. Some of the Arum tribe that are used on these occasions are not only unwholesome but poisonous; to avoid their deleterious effects they are repeatedly boiled ere eating. Of the various fruits they are eaten ripe as they come into season. The banian, peepul, and country fig furnish food not only to the poor people but to cattle also. The kernel of the mango and the tamarind stone are converted into meal and cooked into porridge or baked into cakes, but as they contain a large proportion of tannin they are not healthy and are only resorted to during seasons of scarcity. The bamboo seed furnishes a kind of rice which is generally collected by the poor during the season at all times to keep them in food. In most jungles there is always a succession of bamboo in seed every year. The fruit of the prickly-pear is eaten ripe; sometimes the green fruits are boiled. The tender leaves would furnish good vegetable for curry, but is not often resorted to, as the prickly-pear possesses sub-acid or anti-scorbutic properties; it is very beneficial to the health both of man and beast. To Mr. H. S. Thomas, the Collector of Tanjore, the credit is due of first suggesting and subsequently demonstrating practically its value as cattle fodder by feeding his own cattle on it and exhibiting the same in public, thus proving its utility; and it has been introduced to public notice by Messrs. Harvey and Sabapathy of Bellary since. It has not met with general acceptance in consequence of the trouble and difficulty of freeing the leaves of their sharp spines, but there is a spineless variety—*Opuntia delenii*, or Nopaul with red flowers—which is met with about Madras. I remember seeing lots of it growing about the village of Karanguli, in the district of Chingleput, some years ago. It would be worth while introducing this cactus into the several districts to form cattle fodder not only during seasons of scarcity, but at all other times.

Note by Mr. W. R. Cornish.—This variety of *Opuntia* was introduced many years ago by the late Dr. James Anderson to feed the cochineal insect. Dr. Anderson used to supply Her Majesty's ships-in-war in the Madras roads with the green leaves, which in those days were used as an anti-scorbutic, after being boiled as an ordinary green vegetable.

The *Guazuma tomentosa*, or Bastard Cedar, was introduced into Southern India from South America very many years ago, to be cultivated for supplying cattle with fodder; they are met with about Madras. The woody seeds are sweet from containing sugar, and they are eaten by the poor during seasons of scarcity, but cattle are partial to both leaves and fruits. This tree also yields good fibre, and its extensive cultivation into the several districts is well worthy of attention with a view to supply fodder for cattle during seasons of scarcity. The Bassia, of which there are two varieties, from the fleshy corolla of which most of the semi-wild tribes distil their arrack, the flowers being sweet tasted, are eaten raw, boiled or roasted, and the ripe fruits during the season. The kernels furnish a coarse oil, which is used as food. The palmyra tree is too well known for the various useful products it furnishes. The fusiform root of the germinating stone is boiled and sold in the bazaars during the season as the palmyra tubers or *Pannei Kulungu*; this is also converted into meal, and the stones of the fruit are carefully collected and put down to germinate for the purpose of securing the roots.

I will not extend these remarks further, as the parts used and the mode in which they are prepared are given opposite each plant.

Note.—Since this letter was written I have been to the North Arcot district on a tour of inspection, and at the village of Poloor in that district saw several large clumps of the Nopaul or Non-spinous cactus growing in a tope. The Tahsildar being absent, I sent for the Sheristadar or Sub-Magistrate, and pointed out the Nopaul to him. I brought with me several specimens of the young plant, and, on receiving a note from Mr. Fernandez of the Government Office on the subject, I sent these plants to him to present to the Chief Secretary to Government.

At Vellore near the toll-gate, leading towards the Central Jail, I also saw several young plants of the Nopaul growing in a hedge with the common Spinous cactus.

In Madras there is a fine specimen of the Nopaul to be seen in a House No. 31, on the High-road, Royapooram, and another in the compound of Trinity Chapel, John Pereira's; both these plants were with flower and fruit when seen by me about two months ago.

A List of Plants the various parts of which are used as food by the poor during seasons of distress to appease the cravings of hunger.

Scientific Names.	Tamil Names.	Telugu Names.	Remarks.
1. Acalypha Indica	Koopay maynei	Hurita munjari	Grows wild, leaves used as greens.
2. Achyranthes aspera	Nahi ooroovi keeray	Ooteraynie	Ditto ditto ditto.
3. Arua lœnata	Kunpolay keeray	Pindie conda	Grows wild, and cultivated, the leaves eaten.
4. Agati grandiflora	Aghati keeray	Agisi, Bakapushpam	Leaves, flowers, and tender legumes largely consumed by the poor; sold in the bazaars at one pie the pound; when freely eaten, causes diarrhœa.
5. Æschynomene aspera	Sudday keeray	Jilugu benda	Grows wild, the leaflets used as greens.
6. Aloe Vulgaris	Kuthalay	Kalabanda	Grows wild, the leaf-bud or cabbage and tender pith eaten. The common food of villagers during the famine.
7. Altenanthera sessilis	Poonanghucunny keeray	Madanaganti, Ponnaganti	Grows wild, leaves used as greens.
8. Amaranthus campestris	Siru keeray	Teseri kura	Grows wild, and cultivated, used as greens.
9. " frumentacious	Poong keeray	Tota kura	Grows wild, and cultivated, leaves used as greens, and the seeds converted into meal.
10. " spinous	Mooloo keeray	Mulugoranta	Grows wild, leaves eaten as greens.
11. " tennifolius	Kattoo Siroo keeray	Doggali kura	Ditto used as greens.
12. " tristie	Kuppei keeray	Koyyatota kura	Ditto ditto.
13. Amorphaphallas campanulatus.	Kurruna Kalungu	Konda, muncha kunda	Ditto about hills and forests, and the tubers boiled and eaten.
14. Aponogeton monostachyon.	Kotee kalungu	Nama	Ditto found in tanks, brooks, and nullahs; tubers boiled and eaten.
15. Arum lyratum	Kondai rakis	Konda rakis	The roots are eaten after careful boilings.
16. Asystasia coromandeliana.	Midchy keeray	Mukku mungera, Tappeta	Grows wild, used as greens.
17. Atriplex heteranthera	Thoyah keeray	Thoya kura	Do. do. do.
18. Bambusa arundinacia	Mungil arisee	Voduru	Seeds of the bamboo furnish food (rice) to the poor, and the growing young shoots cooked into curries.
19. Bassia longifolia	Elloopie	Ippa	Grows wild, the deciduous fleshy corolla eaten either raw or roasted, and the fruits when ripe. The seed contains a bland oil used in cooking.
20. " latifolia	Caat elloopei	Ippe	Do. do. do.
21. Bergera Kœnigii	Karaway pillay	Kuri vepa	Do. is also cultivated, fruits eaten.
22. Boerhavia procumbens	Mookaretti keeray	Ataka mamidi	Grows wild, leaves and tender shoots used as greens.
23. Boerhavia repanda	Mookooty keeray	Maildinica	Do. do. do.
24. Borasus flabelliformis	Pannei	Karatalamu, Tatichettu	Fruits and leaf-bud or the cabbage is eaten as also the fusiform roots.
25. Bryonia rostrata	Appa kovay	Putribudinga	Grows wild, fruits and leaves eaten.
26. Byttnera herbacea	Arce keeray	Arce kura	Do. leaves used as greens.
27. Calladum esculentum	Saimmay keeray	Chama kura	Do. leaves eaten as greens.
28. Cantheum parvifolia	Carray cheddie	Balusoo kura	Do. leaves and young shoots used as greens.
29. Cardiospermum halicacabum.	Moodacottan	Budda kankarakoo, or Nella goolisienda	Do. do. do.
30. Caralluma adscendens	Kullee mooliayan	Karallamu, Taviti chettu	Do. tender shoots used, cooked as vegetable.
31. Carissa corindas	Kalakai	Wakay okachettu	Grows wild, fruits are eaten.
32. " diffusa	Chothay kalakai	Kalive chettu	Do. do. do.
33. Cassia sophera	Poonaverie	Pydee tanghadu	Do. leaves used as greens.
34. Cathartocarpus fistula	Koonnay	Rela	Do. the mucilagenous pulp from the pods eaten.
35. Celocia cristata	Punnee keeray	Erra kodi, Juttu tota kura	Grows wild, leaves and young shoots used as greens.
36. Cicus quadrangularis	Purundei codie	Nullerootigeh	Do. do. do.
37. Cleome pentaphylla	Valay keeray	Vaminta...	Do. leaves used as greens.
38. Cossinia Indica	Covay kai	Donda, Bimbika	Do. ripe fruits eaten.
39. Colocasia antiquorum	Shamay kilangu	Chama dumpa	Do. and cultivated, leaves and leaf stalks eaten.
40. " nymphæfolia	Karoonay kilangu	Gadda kanda	Grows wild, and cultivated, the tubers are cooked.
41. Commelina communis	Kannang keeray	Gangi gadda	Grows wild, leaves and tender shoots used as greens.
42. Cordia myxia	Vidi maram	Iriki, Nakerachettu	Fruits eaten during the season.
43. Corchus olitorius	Katt thootheo, or Jews' Mallow	Parinta	Grows wild, leaves and tender shoots used as greens.
44. Cucumis momordica	Kaat volleri, Pythum kai	Pedda doskay	Grows wild, fruits eaten.
45. Cynodon dactylon	Aroogum pillo	Garike	Do. tender leaves and shoots eaten.
46. Desmanthus natans	Sunday keeray	Niru talvapu	Do. the leaves used as greens.
47. Dioscorea alata	Yams kalung	Niluva pendalum	Several varieties, grows wild, tubers eaten cooked.
48. Dolichos ensiformis	Kaat Thumbuten kai	Tamma	Grows wild, pods cooked into curries, ripe seeds eaten boiled.
49. Dracontium polyphyllum.	Kaat Curnay	Adive kanda	Grows wild, tubers eaten cooked.
50. Eleusine Ægyptica	Muttengapilloo	Tamida, Sodee	The seed-grains are eaten cooked.
51. Eriodendron anfructuosum.	Elevam	Poor	Found in gardens, seeds roasted and eaten.
52. Erythroxylon areolatum.	Davaahdarum keeray	Devadary kura	The tender leaves are used as greens, grow wild.
53. Euphorbia pilulifera	Amumpatchay arisee	Bidarie, Nanabceam	Grows wild, leaves and tender shoots eaten as greens.
54. Ficus Bengalensis	Alamarum	Marri	Fruits of these and other varieties of the Ficus are eaten ripe.
55. " glomerata	Attee marum	Maydi	Ditto ditto ditto.
56. " religiosa	Arasa marum	Ra, , Raghie	Ditto ditto ditto.
57. Glinus trianthenioides	Sharunay keeray	Golijeru	Wild, leaves used as greens.
58. Gisekia pharnaceoides	Numnelli keeray	Isaka dasari kura	Grows wild. The leaves used as greens.
59. Guazuma tomentosum	Rudrasum	Rudrakscha chettu	The woody fruits when ripe are eaten.
60. Gynandropsis pentaphylla	Neivaylla or kadughoo	Vala kura	Grows wild, leaves and young shoots used as greens.
61. Holostemma Rheedi *	* Palay keeray	Pala kura	Leaves boiled with salt and chillies, and eaten.
62. Hoya veridiflora	Coringee keeray	....	Grows wild, leaves used as greens.
63. Inga dulcis	Coorkapooly	Sima chinta	Ripe fruits eaten.
64. Ipomœa reptans	Vellay keeray	Tegada	Wild, leaves eaten as greens.
65. " reniformis	Perretay do.	Toinnatali	Do. do. do.

A List of Plants the various parts of which are used as Food, &c.—(Continued.)

Scientific Names.	Tamil Names.	Telugu Names.	Remarks.
66. Ipomœa sepinaria	Thalee keeray	Puriti tige	Wild, leaves eaten as greens.
67. Leucas aspera	Thombay keeray	Tummi kura	Grows wild, leaves and tender shoots eate as greens.
68. Maba buxifolia	Erimbellie kai	Pishanna	Grows wild, ripe fruits eaten.
69. Mangifera Indica	Mankai	Mamedi chettu	Fruits and seeds, latter converted into mea
70. Melia asadirachta Indica.	Veyppa marum	Vapa chettu	The ripe fruits are eaten as they contain small quantity of sweet pulp betwe stone and skin.
71. Mimusops elengi	Moghadum	Poghada	The ripe fruits are eaten.
72. Mirabilis jalapa*	Undi Mandarei	Badracha, Nitcha mulligah	The leaves are used as greens largely i Oossoor in the Salem District.
73. Morinda citrifolia	Munja pavattay	Molagha, Maddi chettu	Grows wild, green fruits curried, ripe eaten.
74. „ umbellata	Noona kai	Moolooghoodoo	Ditto ditto ditto.
75. Nymphæa edulis	Shunguneer pushpum	Koteka, Kalharamu	Grows wild in tanks, there are two or thre varieties according to the coloring of th flowers. The roots and seeds are eate cooked.
76. Œgle marmelous	Vilva marum	Maredoo	Grows wild, the ripe fruits are eaten.
77. Opuntia vulgaris	Chuppauthumoolloo	Nagamala	Grows wild, the ripe fruits are eaten, th green fruits and tender shoots may b cooked into curries.
78. Oxalis corniculata	Pooliaray	Pullachinta	Grows wild, leaves and tender shoots cooke as greens.
79. Pandanus odorata	Thalay	Mogheli	Grows wild, the floral leaves are eaten rav or cooked, and the lower part of the drupe of the ripe fruits are sucked of thei pulp.
80. Phaseolus rostratus	Karalsona	Karalsana, Karu alachanda	Grows wild, the tuberous roots are cooke and eaten.
81. Phœnix sylvestris	Etham pannay	Ita chettu	Grows wild, leaf-bud or cabbage and rip fruits eaten.
82. „ farinifera	Ethee	Chiruta-ita	Do. do. do.
83. Portulaca oliracea	Paroopoo or corie keeray.	Pedda pail kura, Ganga pavilli kura	Grows wild, leaves and tender shoots are cooked and eaten as greens.
84. „ quadrifida	Passelie keeray	Goddu pavelli, Sun pail kura.	Do. do. do.
85. Premna serratifolia	Mooney do	Ghebboon nellie	Do. do. do.
86. „ latifolia	Nella do	Pedda-nella-kura	Do. do. do.
87. Prosopsis spicigera	Parumbay	Chammee, or Jammi chettu	Do. do. the meals from the pods are eaten.
88. Remna latifolia*	....	Nelli kura	These herbs are gathered and boiled with some salt and chillies and eaten.
89. Rivia hypocrater formis.*	Boodthee keeray	Boddi kura	Do. do.
90. Rothia trifolita	Nurreypitten keeray	Nucka kura	Grows wild, leaves and legumes used as greens.
91. Salicornia bracheata	Oomarie keeray	Quoiloo, or Koyaloo	Grows wild, leaves and shoots used as greens.
92. „ Indica	Pavala poondoo	Koyya pippali	Used as a pot herb.
93. Salsola Indica	Yella keeray	Yella kura	Wild, leaves used as greens, largely resorted to during famines.
94. Schleichera trijuga	Poomarum, Conjee marum	May Roa Tanglia	Grows wild, ripe fruits are eaten,
95. Schmidelia serrata.	Tanalika	Tanalikoo korra chettu	Grows wild, fruits are eaten.
96. Sesuvium portulacustrum.	Vungaravasee	....	The leaves and tender shoots used as a pot herb, grows wild.
97. Sethia Indica	Tavadrum, Semmanatty	Adivi gerenta, Davadalay	Grows wild, leaves and tender shoots eaten as greens. This tree has afforded food to many thousands of people during the famine.
98. Solamun incertum	Munnuthakallee	Kakamachi	Grows wild, leaves and young shoots used as greens, ripe fruits eaten.
99. Solamun jacquini	Cundung katrie	Van kuda, or Nella molunga	Grows wild, fruits are cooked into curries.
100. Solamun torvum	Soonday kai	Choondai kai	Grows wild, fruits used as vegetable.
101. Spondus mangifera	Mirrey mauga	Ambra, or amra journ, Mamedi	Grows wild, leaves used as greens, fruits cooked into curries and pickled.
102. Sterculia fœtida	Peenaree marum	Gurapa Badam chettu	Grows wild, the roasted seeds are eaten.
103. Strychnos potatorum	Tettan cotta marum	Toillaghenjaloo, Induga	Grows wild, fruits when ripe are eaten.
104. Suæda Indica	Koyey kasseray keeray	Kodee kassecry kura	Used as a pot herb, grows wild.
105. Syzygium jambolanum	Naval	Neradi	Grows wild, ripe fruits are eaten.
106. Tamarindus Indica	Poolia marum	Chinta chettu	Leaves, young shoots, fruits and seeds are eaten, the latter converted into meal.
107. Toddalia aculiata	Moolacarnay	Conda cashnida	Grows wild, leaves are used as greens.
108. Trapa bispinosa	Singahara	Kubyakam	Do. seeds are cooked and eaten.
109. Trianthema obcordata	Sharunnay	Ghelijohroo	Do. leaves and tender shoots used as greens.
110. Trianthema obcordate. *Var.*	Shavalay keeray	Tella ghelijeghroo	Grows wild, leaves used as gresns.
111. Trichianthis cucumera	Pepoouel	Chayud potta	Do. fruits curried.
112. Trilobus terristus	Neirenji keeray	Palleroo	Do, leaves used as greens.
113. Urtica tuberosa	....	Pilli dumpa	Do. tuberous roots boiled and eaten
114. Vellarsia cristata*	Nedel ampel	Alli gadda, Antaratamara	This is a species of water lily found in tanks and wells. The substance found in the plant is cooked or merely boiled and eaten.
115. Xanthochymus pictorius:	....	Jevra memadie	Grows wild, ripe fruits.
116. Ximenia Americana	....	Oora nechra, Konda nakkera	Do. do.
117. Zizyphus jujuba	Yellanday kai	Reygoo	Ripe fruits.
118. Leptadenia reticuiata.†	Palacoody	Kalassa	The leaves and tender shoots used as a vegetable in the Vinucondah taluq, Kistna, and all times.

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† This plant was sent to me by the Collector of Kristna for identification, and "that it was eaten by the villagers of Vinucondah taluq as a vegitable, but which they are now using as food. I have identified it as the *Leptadenia reticulata*.

[illegible]

ON THE PROGRESS AND SCIENTIFIC DEVELOPMENT OF AGRICULTURE.

BY J. ARRHENIUS, SECRETARY OF SWEDISH ACADEMY OF AGRICULTURE.

Translated for the "North British Agriculturist."

THAT the covering of the ground with sand, moss, or any other loose matter, has the effect of retaining moisture, is well known, and practically applied in horticulture. Even in woods the trees and covering of fallen leaves and needles are of great importance for retaining moisture in the earth, as Ebermayer has recently shown by direct experiments. The evaporation in a wood, where the covering of leaves, &c., has been removed is one-half less than that on similar ground without trees. The effect of the shade of the trees is thus clearly apparent. The motion of the air is much less in the wood than on the exposed ground, and on account of the shade from the trees the temperature of the air and the ground is lower than in the open field; and if the covering of leaves, &c., is allowed to remain in the woods, the evaporation from the surface of the ground there is only a fourth or a fifth of that from an unwooded field. The covering of the ground also diminishes the radiation of heat, and thus delays its cooling. Here we find also an explanation of the well-known fact, that fertility is increased and the liability to frost diminished of bogs and mosses which have been brought into cultivation by covering them with sand or clay. We often see the seed frozen out on such soils, while on the parts that have received applications of sand or clay, the seed remains unfrozen. We have already directed attention to the importance of this operation as of great value for securing the future fertility of cultivated moss lands and we consider that we ought to point out that, after the scientific researches of the last few years, and the experience that has been obtained in the practice of agriculture, the partly renewed burning of bogs and mosses has been properly condemned as unreasonable, and leading to the speedy destruction and barrenness of the moss lands thus treated. Burning on such ground ought only to be employed when the field is brought into cultivation, when the tough, unfertile turf, together with stumps of trees and other refuse, may be most conveniently got rid of by burning, while the field at the same time gets a valuable manuring with the ashes. But when mossy ground has been thus brought into cultivation, it ought not to be afterwards burned. It ought instead to receive an application of clay or sand, and if it is afterwards properly manured for every crop with super-phosphates and potash salts, it can be maintained continuously in complete fertility, and will yield very abundant crops both of grain and fodder. Cultivated fields, rich in humus also, require no nitrogenous manure, humus being so rich in nitrogen that any additional application of it to such fields is unnecessary; but they ought, on the contrary, to be manured with phosphoric acid and potash and when this is done they may be brought to and maintained in a high state of fertility. Our bogs and mosses, when thus treated, appear to possess a far higher value than has formerly been assigned to them, and our country shall in the future without fail draw great advantages from those extensive tracts of bog and moss, which in their natural state are not only not of any use, but, on the contrary, hurtful, as frost-nests from which cold and destruction so often spread over the neighbouring cultivated fields.

Artificial manures continue to be more and more generally used, and experience on the large scale has established their value in agriculture A new and very valuable preparation has during the past year come into the market, namely, O. H. Schmiedte's latrine phosphate, which deserves the notice of the farmer for its richness in phosphoric acid, nitrogen, and organic constituents; and this manure, in the experiments we have made with it, has shown itself to be very good. The manure works in Dalecarlia, previously noticed by me, has sent into the market finely pulverised mineral phosphates (undissolved), which phosphate meal can be recommended for making composts when, in mixture with organic substances which while decomposing give off carbonic acid and ammonia, the phosphoric acid in the phosphate meal is rendered soluble, and available for cultivated plants. Such a mode of treatment was experimented on during the past year at Halle, and is recommended by Holdefleiss in a treatise published by him under the title "*Aufschliessung des Phosphorits durch Compostirung*," it having been found that phosphates are rendered soluble most easily in peat or mud which is moistened with liquid manure, or when an ammoniacal salt has been used instead of the latter. These experiments are of so much the greater value for us, as we have on most estates plentiful supplies of peat and rich earth, and by watering it with urine, of which we have large quantities during our long house-feeding season, we have good opportunities of making such composts, and can thus in the simplest and least expensive way obtain more abundant supplies of food for the plants we cultivate.

From experiments which Professor Lehmann (*Centralblatt für agrikulturkemie*) has set on foot in order to ascertain the most suitable form under which nitrogen can be supplied as food to plants, he has come to the remarkable conclusion that certain plants only take up nitrogen in the form of nitric acid, while others, on the contrary, only assimilate it in this form, during the latter half of their period of vegetation, nitrogen being taken up during their first development only in the form of ammonia. The former, on this account, have been called *nitric acid plants*, the latter *ammonia plants*. It is a fact which has been long known and constantly applied in the practice of agriculture, that some plants cannot bear any manuring with fresh dung, while others stand it exceedingly well, and the succession of crops in rotations has been arranged accordingly. Now we have the fact explained. Nitric acid plants do not thrive after an application of fresh dung, until its ammonia, after the lapse of a year or two, has been converted into nitric acid, which takes place on the decomposition of the dung and the oxidation of the nitrogen in the earth. Ammonia plants, again (for instance rye and oats), find, after manuring with fresh dung, the nitrogen which they require in the shape of carbonate of ammonia, and they take it up both under this form and later as nitric acid. The practical method of going to work has thus in this point, been explained and elucidated by science.

A. L.

WHEAT PRODUCTION.

AS bearing on the question of a continued supply for the world's wheat market, it is essential to enquire how far the exhaustive system prevails in new countries, and whether any efforts have been made to counteract its tendency. On these points we find very full information in recent publications of American societies. The State of Michigan, for instance, was adduced by Professor Johnston, of Durham, as a shocking example of the effects of the exhaustive system, continued cropping having reduced the yield of wheat from over 25 bushels to about 10 bushels per acre. But in Michigan there is now a State Board of Agriculture, with a college and numerous institutes, in which valuable lectures are delivered showing the evils of the existing system, and the various available remedies. In a lecture by Mr. C. L. Ingersoll, published last year by the Michigan State Board of Agriculture, facts are stated which completely confirm the statements of Professor Johnston, and the comparative failure of the means employed to improve the system of cultivation. Mr. Ingersoll's lectures was not only approved and published by the State Board, but was delivered at Farmers' Istitutes in five important districts during January and February 1876. His accuracy, therefore, is unquestionable. At the present moment the following facts from such a document are of startling significance:—"The deliterious system of cropping their farms practised by a large majority of our farmers, and their selling all, or nearly all, of the products without returning manures to their farms, cannot but tell in time on their prosperity and the value of their farms. They are, perhaps, making money, but their farms are more than that amount of money impoverished. The fact that the yield of wheat, corn, oats, and other grain is gradually falling lower and lower calls loudly on Michigan farmers to investigate this evil, and remedy it Not that we are worse than our sister States. . . . In the 12 States where most wheat is raised, the average in the last 10 or 15 years has fallen from three to five bushels per acre, and this in the face of the fact that much new land is opened up each year, and sown to wheat, on which large crops are raised. Of these States I will mention Indiana, Illinois, Michigan, Iowa, and California, which are eminently wheat-growing States."

Mr. Ingersoll, like M. de Lavergne, is much impressed with the importance of farmers keeping a large proportion of stock, and he quotes from *Appleton's Encyclopedia* statistics which show a very lamentable deficiency. M. de Lavergne stated that the total yearly animal produce in England was equal to the total vegetable produce, while the animal produce in France was as two-sixths to fourth-sixths. But in the United States we find that 10 principal vegetable crops raised in 1873 were valued at 1,661,505,048 dollars, and that the total value of the stock owned was 1,684,131,692 dollars, so that the value of the *annual* vegetable production was nearly equal to the value of the *whole live stock*. Like M. de Lavergne, he considers manure from stock the best and cheapest fertiliser, but he very fully demonstrates that this opinion is something more than a theory. He quotes experiments of Mr. Lawes in England during a period of 22 years. To the vast importance of these M. de Lavergne called attention, but they were only commenced at the time of his visit. Five plots were cultivated, and were treated each year precisely in the same manner. The first was unmanured, and produced an average of 14¼ bushels per acre in the 22 years. The second, well manured with farm-yard manure, averaged 35¼ bushels. The third, treated to 200lbs. ammonial manure per acre in the autumn each year, averaged 34¼ bushels. The fourth, the same applied in spring, averaged 37¾ bushels. The fifth, treated to the same amount of nitrate of soda, averaged 37 bushels. This showed the value, of manures to land if cropped continuously, and proved that "well-trotted farm-yard manure, in liberal doses, is about as good as the commercial antidotes for poor land." The remainder of Mr. Ingersoll's lecture is devoted to a discussion of the various breeds of cattle suitable for the farmer. He strongly recommends pure stock, the breeds of which he describes. He, finally, urges the necessity of feeding well. A farmer should not look upon stock that consume a great deal as expensive. They should be, as they are, machines to work up the products of the farm and turn them into more saleable productsand also manure, as not without liberal supplies of the latter can any farmer hope to succeed well.

If the subject of agricultural improvement has been so well discussed in the Western States, it may be imagined it has not been neglected in New England, where the farming community is second to none in intelligence. Nowhere, accordingly, do we find the whole of the questions more ably discussed than in the winter meetings of the Connecticut State Board of Agriculture, which comprises in the list of members practical farmers, experts, and professors. In 1873 the Secretary read an essay on the fertility of land, its causes and remedies. In the discussion which followed a remarkable experiment was described by Dr. Riggs, of Hartford, as follows:—He ascertained to his satisfaction that there is no farm in the State of Connecticut that is able to carry cattle enough to make barn yard manure sufficient to bring the land up to a high state of cultivation. He found, also, that the city manure was too expensive. Even the fertilisers are sold at too high rates. The phosphates, the guanos, and nearly everything that could be named sold throughout the country as fertilisers, are double, and some treble, the price they ought to be. In these circumstances, said he, "I began to inquire from what source I was to make my land fertile, and enable me to get a crop. I then began to look into the question of what manure was. I found that manure was simply a plant passed through an animal, with a portion of its goodness taken out and utilised by the animal for putting on fat and flesh, and that nothing was added to it except the bilious secretions of the animal, a little grain of resin or resinous matter, with some albumen. I said why not supply these materials to the soil by putting this plant back into the soil before I pass it through my cattle?" The doctor went to work, and put in the crop that would grow the quickest, so that he could use the land another year for another crop. He found that rye, or wheat was the only crop that he could use for the purpose. Clover is the best crop, because it produces more, brings up the material matter from a greater depth, and leaves it so near the surface that other plants can feed on the material when the plant is dead or decayed; but it takes clover two years to grow. He found rye the next best crop. By sowing a bushel and a peck of rye to the acre, preparatory to a tobacco crop, he found the rye averaged 6ft. 4in. or 5in., growing very rank. His rule was to keep ploughing. Just as fast as one crop is matured plough it in, put on another, and plough that in. With reference to the cost and the result, the doctor in reply to comments made by some members, said—"It costs a farmer in our section of country from 200dollars to 300dollars to restore the fertility of his tobacco land. It costs me 50dollars." He afterwards said that on best tobacco lands the farmers spend 300dollars or 400dollars on an acre, In the discussion which followed the members generally agreed that the experiments made were very important, Professor Johnson only suggesting that probably the plan was better adapted for light soils than for clay lands.

From a lecture delivered at one of the meetings of the same board, by Professor Atwater, it appears that in no other State of the American Union has so much been done as in Connecticut for the application of chemistry to agriculture. During a visit, however, of several years to Europe, Professor Atwater found that, in regard both to the quality and price of fertilisers, even Connecticut was far behind both England and Germany. He said the progress made in England was chiefly owing to the wise liberality of the Royal Agricultural Society, and the labours of Dr. Voelcker their talented chemist. In Germany the chief improvements had been effected at the public expense, by the establishment of experimental stations, where the farmers got accurate analyses of manures promptly and at a small cost. In Connecticut they had not a rich and liberal Royal Society, neither had they a paternal Government like that of Prussia—and the same remark applies with equal force to Victoria—but the lecturer saw no difficulty in the farming interest, by association, effecting for themselves what in other countries had been done for them by others. The Professor said the first expenditure was the chief difficulty, but the example of Germany, and especially of Prussia—which, by the cultivation of science, had been raised from an insignificant position to that of the first power in Europe—showed that the cost was soon, and very amply, repaid. In no respect, speaking of Prussia, was the scientific spirit more manifested than in the diffusion of knowledge amongst farmers, in the establishment of agricultural schools, experiment stations, and other institutions where scientific investigation and practical experience are combined in such a manner as to make them of the highest service to the community The first impulse of educated men was to combine in supporting, and availing themselves of, the Government institutions. In connexion with agricultural experiment stations there were in 1868 nearly 2,000 associations in Germany. The stations consist of chemical laboratories connected with stables, fields, gardens, or green-houses, where men of high scientific acquirements and practical skill are engaged in analysing manures. These stations, and their mode of working, were fully described by the lecturer. In answer to a question, Professor Atwater said a useful station could be started in Germany for 6 000dollars, and that its annual cost "to run it" would be 3,000dollars. After a long discussion, during which Dr. Riggs, who had given up buying fertilisers, expressed his approval of the system described by Professor Atwater, and recommended its adoption in Connecticut, the Board passed a resolution that it was expedient to take the matter into consideration at an early date.

In no country in the world has the exhaustion of the soil been more systematic and continuous, and nowhere has it of a late attracted more intelligent attention, than in America. This attention has already borne good fruit. It is notorious that the citizens of the United States are proud of their country, of their people, and of their institutions, and they are slow to believe that in anything they are surpassed by other countries. The stern logic of facts, however convinced them that their system of farming was defective and they had the courage to send professors as well as students to Europe to examine the systems which had stood the test of time. Among the students none is at the present moment more eminent than Professor Atwater, and we have great pleasure in directing attention to a summary of the suggestions and information communicated in a lecture by him to the Board of Agriculture of Connecticut. The lecture is of special importance to the farmers of Australia, because their circumstances and conditions are almost identical with those of the audience whom he addressed. At the beginning of his lecture Professor Atwater pointed out that he had been especially attracted by the remarkable progress and perfection achieved in Germany in the use and application of manures. In America land was cheap and labour dear, and the attention of the farmer had been chiefly directed to labour-saving machinery and implements. In Germany land was dear and labour was cheap, and the greatest economy in the use of land and manure had been necessary. While American ingenuity had produced machinery and implements which were used throughout Europe, the time had come, the Professor said when the American farmer would find it not merely advantageous, but necessary, to profit by the lessons of economy and skill in the use of manures which the scientific spirit of the Germans had perfected. The perception of an evil is the necessary preliminary to reform, and it is refreshing to find that there is no evasion on the Professor's part. He said, "Many years of irrational cropping have so far exhausted the fertilising elements of the soil in many sections of our country, that it can no longer yield the bountiful returns that once rewarded the husbandman's toil. The products of the barnyard and stable alone, even if rigidly economised, are insufficient to supply this lack, so that to get full crops we must, perforce, make use of artificial fertilisers. Rightly to select, as well as rightly to use, these articles requires knowledge of scientific principles." In travelling through Europe, and especially in England and Germany, the first thing that attracted the Professor's attention was the marked superiority of their fertilisers compared with those of America. He gives comparative tables showing the maximum, minimum, and averages of nitrogen, soluble and insoluble phosphoric acid, from which it appears that the average German superphosphate is equal, or even superior to the best American. The average German contains nearly twice as much nitrogen, and four times as much soluble phosphoric acid, as the average American superphospate. On the other hand the American contains more insoluble phosphoric acid than the German, and, in addition, the latter in general were better prepared and more finely pulverised than the American. Conversing afterwards with Dr. Voelcker, the chemist of the Royal Agricultural Society of England, Dr. Atwater found that in prices and quality there was no material difference in the fertilisers of England and Germany. The state of the market fifteen years previously was in the two countries much about what it was in America at the time the Professor delivered his lecture. Dr. Voelcker said the cause of progress in the two countries was similar. The farmers were enabled, at a cheap rate to ascertain the value of the fertilisers, and hence the competition among importers and manufacturers was based upon goodness of quality rather than price. "Years ago farmers used to buy the guanos and superphosphates without much reference to what chemical analysis would say of them, looking rather to the way they were recommended or their practical experience with them, and to the money they cost per ton. By this plan manufacturers were tempted to make inferior articles and sell them at cheap rates. But farmers have learnt that a guano with 12 per cent. of nitrogen is worth more than one with only 10 per cent.; and that a real superphosphate, containing soluble phosphoric acid, is worth more than one in which the phosphoric acid is insoluble, and they therefore give the preference to such articles." What has been done in England by the Royal Agricultural Society and by private institutions has been accomplished in Germany chiefly by the State, with the aid of numerous associations. In Germany chemical laboratories are provided by the Government, and by agricultural societies, in which merchants can have the fertilisers they sell, and the farmers those they buy, analysed at moderate prices. "When a German farmer buys a fertiliser he pays for it not by the weight or ton, but according to the amount of valuable material of active fertilising ingredients contained in a hundred-weight or ton. Guanos, superphosphates, bonedust, and pondrettes are made up of various subtances, among which are, more or less, sand, lime, magnesia, iron, potash, soda, nitrogen as ammonia or nitric acid or in some other form, and phosphoric acid in the shape of phosphates. The sand has no agricultural value, nor can the farmer afford to pay for lime and magnesia, the prices at which many commercial fertilisers are sold. What he most wants is nitrogen, phosphoric acid, and, perhaps, potash, and he wants these in a form in which they will be useful to the plant, Accordingly, in Germany fertilisers are sold at prices based upon their chemical composition, and are warranted by the seller to contain certain percentages of these valuable fertilising ingredients."

Professor Atwater devotes a great part of his lecture to a description of the system of experiment stations, and the fertiliser control, system in Germany. The agricultural experiment stations consist of chemical laboratories, where men of high scientific acquirements and practical skill are engaged in studying and experimenting on questions of importance in agriculture. Besides a variety of more abstract researches they make a great many analyses of commercial fertilisers. The first German station was founded in 1851 at Moeckern, in Saxony, by some enterprising agriculturists aided by the Government. This station proved so useful that others were started They spread through Germany and into other countries, and in 1873 there were no less than 62 institutions of this kind in Europe. Governments and agricultural societies unite in supporting them. Some of them gain revenue from their analysis, and private persons largely contribute to their maintenance The farmers give liberal aid because they find that "it pays." In convenience the station is frequently in connexion with a farm, and certain portions of land are set apart for experiments as to the effects of different fertilisers and of modes of culture on the growth of various crops.

At the Moeckern station a long series of experiments were made to determine the influence of food in changing the composition of milk. Of late, however, it appears there is now a division of labour, some stations being devoted to, investigations in animal and vegetable chemistry and physiology and others to analysis of fertilisers. In general these stations are mainly supported by the Government. In consideration of this support, the people at large can have analyses whenever they choose, but must pay a small sum for each. The system of experimental stations, however, would be of little benefit if they were not actively aided by societies and by the people, as well as by all respectable dealers and manufacturers. The usefulness of these institutions is likewise greatly promoted by the agricultural press, which publish full accounts of the investigations made at the stations. In the year 1866 there was considerable excitement in Prussia about the bad quality of the fertilisers. A more vigilant control was thereafter exercised. Dealers and manufacturers put themselves under the supervision of the stations. They got analyses made, and guaranteed a certain percentage of the various ingredients. The stations occasionally took samples and analysed them. Frequently also the purchaser got analyses of what he bought. By these means a great improvement took place in 1867 and in subsequent years a vast saving was affected by the farmers. To show the working of the system, Professor Atwater describes the case of Messrs. Kroebbe and Co., in Halle, who had placed themselves under the control of a station. This firm made an arrangement by which their stock is always open to the inspection of chemists, of the station. The chemists visit without previous notice, inspect the stock and take samples to the station for analysis. These analyses are called "revision of stock." In addition to this, the dealers themselve on receipt of new wares send samples to the station to be analysed. The analyses are printed in the agricultural journals, and copies of the reports are posted in the company's store. Sales are made on the faith of the analysis where the dealer is under control of a station, but many buyers get a fresh analysis when making a purchase.

Some of our readers may not be aware that practically there is an experiment station in this country. The Victorian Department of Agriculture gives analysis free of expense, but the system of control—which is probably the most valuable portion of the European station duty—is not yet established in Australia. It does not appear that any dealer or manufacturer as yet has put his stock under control. Meanwhile, it would be an advantage if the Secretary for Agriculture would report a summary of the analyses made by the department, which would show the purity and value of our manures as compared with those of other countries.

After what has been said of the gradual exhaustion of fertility in the wheat lands of America, it is not surprising to find that in the annual reports upon agriculture presented to the United States Congress this subject occupies a prominent place. The Commissioner of Agriculture gives large extracts from various authorities in order to show the importance of ascertaining the true value of fertilisers. Scientific and practical experiments show that the value of a manure greatly depends upon the readiness with which its fertilising ingredients become available. For instance, steamed and very fine pulverised bone dust is worth at least a third more than the coarsely-pulverised bone. For the same reason phosphoric acid is worth two or three times as much as superphosphate, that is in the soluble form, as it is in the insoluble form. It is found that the chief defects of the artificial fertilisers in the United States are the small quantity of the soluble phosphate; in the superphosphates, the rather small contents of nitrogen, and in many cases, the lack of fineness of pulverisation. The only mode of securing a really high-class article is the system of analysis and the publication of the results. It is mentioned that by employing Dr. Voelcker, the eminent chemist, to make analyses and to publish reports on the principal manures, the Royal Agricultural Society had secured for England as much benefit as had been derived from the experimental stations in Germany. A lecture quoted by the commissioner, however, says—"The only practically reliable security for the just regulation of the trade lies in the vigilance of the consumers themselves. Whoever buys an article of whose value he is uncertain must expect to be cheated." The commissioner directs attention to lectures and discussions which took place at the Connecticut State Board on the subject of stable and barnyard manures, night-soil and muck. This last term, in America, is applied to a compost chiefly of mould. Mr. Beard, a practical farmer, said he had used muck taken from the bottom of a dry pond to great advantage in renovating pasture lands, and he was of opinion that it showed its effects for 20 years. He had also used it for potatoes, corn, and tobacco, with very good results. Mr. Fowler, another farmer, was equally emphatic in favour of top-dressing. He used almost all the manure he made on the surface both for meadows and ploughed land. He stated that he could show more than double the quantity of corn upon the ground which he top-dressed than his neighbours could upon ground on which they applied the same quantity of manure and ploughed it in. Professor Johnson said that to some extent these were opposite experiences, but there were necessarily good reasons for the differences. "Fresh stable manure contains some 70 per cent. of water, 25 per cent. of vegetable and animal matters, and 5 per cent. of salts and mineral substances. If we put the manure on a clothes strainer and slowly wash it with the rain of a watering-pot, we shall dissolve a portion of the organic matter, some 2 per cent., and a portion of the salts, some 4 or 5 per cent., and we shall, perhaps, drive through the cloth some of the fine particles of the manure that do not actually dissolve, but the coarse parts will remain on the strainer. The same happens to the ground. The most active fertilising ingredients are carried into the ground in solution. The undissolved matters, which exist in a state of fine division, are mechanically carried into the soil to an extent depending on its porosity, while the coarse matters, the straw of the litter, remain on the surface. As to the dissolved matters, they are not lost unless the soil is coarse and open, but even in the latter case, if it be full of grass roots or grain roots, they will absorb the greater portion, and the farmer may do well to lose a part in order to put another greater part where the growing crops will be certain to pay back for all the expenditure and give a margin of profit besides." But probably the most important paper and discussion were those upon night-soil. The paper was read by Professor W. H. Williams, of Columbia. It seems to be difficult to over-estimate the benefits of night-soil. On this subject numerous facts and authorities were adduced. Professor J. F. W. Johnston, of Durham, a very distinguished chemist, considered it "the most valuable of all the solid animal manures. When dry, few other solid manures can be compared with it. Weight for weight, dried night-soil is equal to 30 times its bulk of horse manure.' To a similar effect Professor Yeomans adduced reports from associations and professors in various States. Professor Hilyard, of Mississippi, in very forcible style, argued from known facts that nightsoil and other refuse from man in a civilised state were sufficient to maintain fertility, and that if they were used as nature intended, in place of being neglected and wasted, there would be no need for guano islands or artificial manures. All the products of our fields, with a trifling exception, ultimately go to serve as food or raiment to man, and hence man's excrements, rags, paper and bone, if returned in the proper form and in the right place, are necessary and sufficient to supply what has been withdrawn. If farther proof was required, it would be supplied by China and Japan, countries possessing a teeming population during long ages. In those countries are hundreds of millions of human beings who have no cattle and no barnyards, and who live almost exclusively upon cereals. Yet they supply annually sufficient manure to insure good crops. This kind of manure is the almost entire dependence of the Chinese and Japanese, and the professor alleges that "from this resource a greater number are supplied with food than are fed from a similar extent of surface in any other portion of the world." "The laws of China," he says, "forbid that any human excrement or urine should be thrown away and reservoirs are placed in every house in which they are deposited. No other manure is used in these cornfields." The lecturer proceeds in detail to discuss the effect which a similar system would produce in America. The estimated nightsoil of England in a single year was equivalent to five million tons of the best guano, and as the United States has double the amount of population, they have annually from this resource, now so much ignored and neglected, equal to 10 million tons of the best guano. The Professor quotes with approbation the language of a report of the Iowa state board, to the effect that "not until the importance of night-soil is fully appreciated will the exhausted lands of the Eastern states regain their lost fertility, and the steady impoverishment of the western prairies cease." The lecturer concluded by discussing the best mode of saving and using night-soil, and strongly recommended dry earth. He said the earth closet invented by Mr. Moule was probably the most perfect system that had been adopted, but it was not necessary that the earth closet should in all cases be used. The dry earth could be applied, and the night-soil could be kept in a privy or in a vault, where even a year's accumulation could be stored. He calculated that with an ordinary family of, say, five or six persons, some two or three, or perhaps more, loads of fertiliser could be saved in the course of the year by the use of dry earth, coal ashes, gypsum, and other substances. The lecturer quoted Nash, who, in his *Progressive Farmer*, says "Night-soil should be removed to the land every spring. Its value as a fertiliser is greatly increased if mixed with six or eight times its bulk of dried peat or swamp-mud It is valuable for all kinds of grain and grass lands. In whatever form it is used it should be spread thinly." The lecturer had compared results with those from other manures, and he found that the contents of a privy vault, mixed with six or eight times their bulk of fine chip dirt thoroughly incorporated and immediately applied to a field of corn, were as efficacious as phosphate. It was applied at the rate of about a pint to each hill, and the corn dropped directly upon it. The maize was quite as good as where a handful of phosphate had been applied. It should be borne in mind that nightsoil is most powerful when promptly used. After the lecture was concluded a member of the board called attention to statements made in the newspapers to the effect that typhoid fever had been caused by milk produced in districts near London, where herbage was enriched by night-soil. On this subject several members gave conclusive testimony from personal experience, showing the innocuous character of the fertiliser. One member had utilised nightsoil for 25 years of the production of almost all kinds of crops. He and his family had in that time constantly eaten of various kinds of vegetables and fruits thus produced. All were good, and if any harm had been done, they had never found it out. On this subject there is a great deal of common sense in the remarks of Dr. Riggs, with which we shall for the present conclude:—" The hardest thing to obliterate from the minds of men is prejudice. Why people should be so prejudiced against night-soil when they can endure the odour of pig manure and many others without being disturbed at all, I cannot imagine. All our manure should be deodorised, and that can be done best and cheapest by the use of common earth. But this earth, no matter if it is light loamy soil, should be dry." Another deodoriser was copperas, which could be bought at less than 2 *cents.* per pound, and three or four pounds would effectually deodorise a cart-load and had also been found to be an excellent deodoriser.—*Australasian.*

CHINA GRASS OR RHEEA.

THE advertisements from the India Office, offering a reward for the best machinery for preparing or cleaning the fibre of the Rheea or China-grass, (*Bœhmeria nivea*) have drawn particular attention to the cultivation and preparation of this valuable product of the vegetable kingdom. The plant belongs to the order of nettle-worts (*Urticaceæ*) and the male and the female flowers are produced in separate spikes, on the same plant. It is a small shrubby plant about three or four feet high, much resembling in habit the common English nettle, throwing up numerous straight shoots, which are about as thick as the little finger and covered with short, soft leaves which have not the power of stinging. Its leaves grow upon long hairy footstalks, and are broadly heart-shaped, about 6 inches long by 4 broad, terminating in a long slender point, and having their edges cut like a saw: the under leaf is white and downy.

In *Der Leinen Industrielle*, the organ of the Dutch and Austrian linen trade, there has lately appeared a very interesting article on this plant and its capabilities. The writer points out that the *Bœhmeria nivea* will grow for fifteen or twenty years in the same soil. In forming a plantation, the young plants should be placed at distances of about a yard apart in both directions. This allows them ample room to develope a vigorous growth, no further care or attention being needed than a superficial weeding in the first year. When of sufficient age the branches and shoots are cut according to the state of maturity which is desired. In hot countries the plants may be cut four or five times a year: in the first year a half crop only can be obtained, but in the second year a full one may be expected. The culture is a very simple and inexpensive one, and the plants require scarcely any nursing or care. They are, moreover, easily propagated, and not liable to be seriously affected by insects. From their rapid growth, by which the ground is speedily shaded or covered, weeds will not grow, and consequently the cost of clearing the ground is avoided.

The difficulties which have hitherto been considered to stand in the way of the full development of Ramea fibre or Chinese grass cloth are the want of a good machine to loosen the fibre from the stalks, and a cheap and efficient process by which the fibre could be satisfactorily prepared. A M. Roland has, it is stated, solved the first of these difficulties by a machine which he has constructed. This machine takes the the fibre off the dry stalk, and so does away with the process of masseration, requiring, in fact, no preparation whatever before being subjected to the machine and leaving but little or no refuse. The cost of this is stated to the about £60: it can be set in motion by one man and is capable of cleaning about 130 lbs. of fibre per day. It has been purchased for the French Government by M. Aubrey Decomte, with the intention of sending it to the French settlements in Guiana, Cochin China, Réunion, and Guadeloupe. All the colonies have in consequence of the inducement offered by this machine taken up the culture of the Rheea. The demand for it is very great, and it is still increasing. The fabric prepared from the fibre is known in England as grass-cloth, and it rivals that of the best French cambric by its softness and fineness of texture. Planters in the colonies who devote themselves to this culture are, therefore, ensured a market for their produce.

Should the machine constructed by M. Roland and patronized by the French Government be found really useful and efficient, we cannot doubt that a most valuable and substantial addition might be made to the products of colonies like Ceylon. The *Bœhmeria* likes a moist soil, and flourishes best in alluvial deposits on the banks of rivers, and generally in the fertile flats such as are found in its native haunts in China and Sumatra. The plant was introduced, we believe, into the Royal Botanic Gardens at Peradenia in 1854, and since that time has established itself there as a weed, growing with all the vigour of an indigenous plant. It apparently prefers the moist banks of the Mahaweli-ganga to the cultivated ground; and judging from its growth at Peradeniya, we may reasonably conclude that thousands of acres of land in the low-country and along the banks of our rivers might be utilized for its systematic cultivation.

From the article in *Der Leinen Industrielle* we gather further that in hot countries four or five cuttings of plants may take place in each year. Each cutting affords about 800lbs. of crude fibre per acre; and taking the value at four pence per pound, three harvests a year would produce crops of the value of over £40 per acre, and counting the expense of culture at so high a rate as £10 per acre, the net sum of £30 per acre remains.

These figures, though only given approximately, are sufficient to warrant further investigation into the merits and capabilities of this plant and its adaptation as a source of material profit to agricultural enterprise in Ceylon. Plants can be propagated with great facility: in fact thousands might be produced in a few months; so there is likely to be no drawback in the matter of supply. Again, in the lowlying flats rich with the best soil of the hills we have most favorable opportunities for giving the enterprise a fair trial. For the proper planting of an acre of land about 5,000 plants would be required, the cost of which when a demand is established would be very trifling indeed.

In justice to our readers we must point out, however, that the success of the whole undertaking depends on the character and construction of the machine; and that this point ought first to be decided before taking up on a large scale the planting of the Rheea. Many enterprises in connection with fibre plants have signally failed in the adaptation of a suitable machine and a cheap mode of cleaning the fibre. We have a right to assume that the French Government has thoroughly satisfied itself on these points before it encouraged the cultivation of the plants in its colonies, and, above all, before it purchased a number of the machines and sent them out to Guiana, Cochin China, Réunion, and Guadeloupe.

A communication from one of these colonies, where one of M. Roland's machines has been successfully applied, appears, therefore, to be the only requisite necessary *to* place the whole enterprise in a practical form before the planters of Ceylon.—*Ceylon Observer.*

THE AGRI-HORTICULTURAL SOCIETY, CENTRAL PROVINCES.

(Report for the year 1877-78.)

CAPTAIN J. W. MACDOUGALL, the Honorary Secretary, has issued his report upon the work done by this society during the past year; the report is full of interesting details and shows that the society has done good work and helped us some steps forward towards the development of the agricultural resources of the country. We take over what is interesting and useful.

Regarding exotics Captain Macdougall says:—In experimenting with foreign plants we have hitherto left them to take their chance against the climate. In some cases we have been successful *vide* the mahogany, edible date, *Pandanus utilis*, and one kind of *Eucalyptus*, the name of which has unfortunately been lost. But in others we have failed. Last year, however, has proved the immense success of the conservatory. The vanille plant which struggled so bravely for an existence is now under glass, taking lovingly to the roof supports, and is weekly making growth. The *Ravenalia Madagascariensis* or traveller's tree for three years did nothing more than exist. It has now under glass thrown out 6 or 7 fine healthy leaves, and will soon be a handsome plant. Palms, crotons, draccenas, caladiums, ferns, and a variety of other plants are growing apace: while the little ivy plant obtained from Simla has thrown out shoots, and seems to like the moisture of the conservatory.

Passing from these ornamental plants to the more useful productions, Guinea grass is now an established crop. It seeds freely, and the seeds when properly sown and tended germinate well. It stands the climate admirably, and is at the top of all fodder crops for hardness. The *Reana luxurians*, also a grass, is an annual, it flourishes on a rich soil during the monsoon, and bears heavy crops of fodder and of seed, so that out of whatever area planted, if ⅛th acre were reserved for seed a good supply would be obtained for a new crop. It does not bear a second crop, but it can be grown in succession, the plants necessarily in the hot season being smaller than in the rains or cold weather; nevertheless a green *bite* for cattle now and then, however little it may be in comparison with the total quantity daily consumed of other food, keeps beasts in good condition. Lucerne has established itself as a fodder grass; it seeds readily, and thus a considerable quantity has been sent out into the province. Contrary to expectation, this grass lived through the monsoon, and with the aid of a top-dressing recovered itself towards the end of October, so that in December a cutting was taken off and the plot has continued to do well. This much, however, has to be recorded against this second year's crop; it does not seed, blossoms come plentifully, but there is a want of fructifying power; probably this arises from the plant being worn out by continued cropping. *Trifolium incarnatum* or Italian red clover did not succeed. The experiment cannot be said to have had a fair trial. The ground was not prepared or seed sown till well into November, and there was hardly time for much success. The *Symphytum asperrimum* was transplanted to a plot trenched 4 feet deep and filled up with manure bones, leaf mould and road sweepings. The plants have thriven better than in the previous year and given more leaf, but a dry climate is not suited to this plant. Again the cattle after munching a leaf or two don't show any willingness to eat more.

The season was against the successful cultivation of English vegetables and flowers. During the year our experiments were however continued with various crops. Some seed of the *baigan* or egg-plant was obtained from the Allahabad district as also from Guzerat. The latter kind was the most esteemed. The crops of each kind flowered freely, but the rains of October and November washed the pollen off and fruits were few. The sugar-cane crop was an excellent one, though limited in area. The benefit arising from liming the soil which had been previously manured and cropped off is seen in the Carolina paddy experiment. A plot measuring 36 yards by 15 yards, or equal to nearly an ⅛th of an acre, produced 238 lbs. of *dhan, i. e.,* the outturn per acre was 1,904 lbs. or 23¾ maunds, an outturn above the average of the country side. Wheat failed again this year; *gherwa* or rust attacked it, and the crop was not worth keeping.

In the previous year's report an experiment was reported as having been made to test the average outturn of clean cotton per tree or bush. A plot measuring 21 feet by 21 feet with plants standing 3 feet apart every way yielded a return of 2 lbs. 1 oz. or about ½ an oz. per tree. This year a plot measuring 22 by 41 with plants standing 3 feet apart every way yielded 3lbs. of clean cotton. There were 98 plants on this area, and we got the same yield nearly of ½ oz. per tree. The first plot was allowed to stand over for a second year, and the return yielded was a little under 4 lbs., seemingly showing that the second year's growth was a stronger and more prolific one. It seems to be an absurdly low yield obtaining only ½ oz. per tree, but there seems to be no reason to doubt it, and this shows the necessity of a much more careful cultivation on the part of a ryot if he wishes to get a really valuable outturn. The present outturn of the best lands does not average over 40 lbs. per acre, and this from many thousand plants; consequently if the above experiment is any criterion, many hundreds of plants in a ryot's field yield nothing. The lesson to be learnt by a ryot therefore, would be thinner sowing, and where manure is obtainable its utilization on some such economical plan as the one now reported on, of planting 3 feet apart in drills also 3 feet apart, and to each pinch of seed a supply of manure.

Carob and mesquit bean seeds were obtained from different quarters during the past year. We have now 288 plants of the former and 95 plants of the latter. These when sufficiently grown will be permanently planted out.

Referring to the experimental cultivation of potatoes by the Assistant Commissioner, Pachmarhi, Captain Macdougall says:—"The experiment with potatoes has been very successful. This is not, however exceptional. Excellent potatoes were shown at the Nagpore exhibition in 1865, grown from common Chindwara seed at Mohtur. A sandy soil is always favourable to potato culture, and if there is any good supply of manure available, Pachmarhi ought always to grow good crops. The Assistant Commissioner's remarks regarding frost injuring the leaf of the Prickly Comfrey indicates deterioration in the plant, for its native habitat is the Caucasus range of mountains, where frost is common enough. The publication of this report may probably lead to other districts publishing the result of their trials; for instance, it is a known fact that there was a large importation of European plants into the Chindwara district. What has become of these? It might be gratifying to the world at large to know whether success has been attained. Again, accidentally one learns that the blue gum (*Eucalyptus globulus*), has become acclimatized at Seoni in the public gardens there. How is it that this Society which distributed seeds of this tree in past years has not been informed of this? It is to be hoped that some attempt may be made to make public all success and failures in experiments tried in the various public gardens of these provinces.

Lastly under this head of experiments, mention has to be made of the success attending root pruning of orange trees. The tree which had been most cut succumbed in the cold weather. Of the rest, a considerable amount of dead wood was taken away, varying according to the severity of the pruning, and new wood has been made in most of the trees; but as yet no signs of increased fruit-bearing qualities. The new wood coming away would of course be against the *ambiabar* or first blossom; and as the *miragbar* or second blossom has not yet come round, we must wait and see what the new wood will bring forth. It would be hasty as yet to pronounce an opinion on this experiment, but after watching the trees it may perhaps be allowable to put forth the theory, that the time of rest in orange trees is in this country exceedingly short, and then it is not a complete rest, such as is known in other and colder climates. Hence when root pruning is practised, the check is more severe, however slight may be the pruning, than one could anticipate, and we consequently find a lot of dead wood.

There were at the close of the year eleven native schools on the roll. They are very attentive to their duties, and one of them is now as far advanced as the head gardener's knowledge can carry him. One or two scholars during the past year found employment in native gentlemen's gardens in the vicinity of Nagpore at more than the average rates of salary allowed to lads of their age. This is the first fruits of the scheme, and it is to be hoped that those who have gone away, will, by their knowledge reflect credit on our training.

MR. J. J. MECHI ON PROFITABLE STOCK FEEDING.

AT a late meeting of the London Farmers' Club, Mr. J. J. Mechi, the Chairman of the Club, read the following paper on

THE MOST PROFITABLE METHOD OF FEEDING STOCK.

I should not have presumed to read to you a paper on this subject had I not some experience. My sales of fat meat, wool, and poultry for the last 10 years amount to £9,977 17s. 11d. (about the average of the last 30 years) so that after deducting £3,019 for lean stock purchased, the actual amount made on the farm was £6,958 19s. 11d. equal to £4 per acre per annum over the whole farm of 170 acres, although one-half of it is cropped with wheat and barley. It is therefore quite clear that our home production of meat might be much more than doubled, for out of our farmed acres (47,000,000 less than 7,500,000 grow wheat, barley, and potatoes. I have only 6 acres of permanent pasture on my farm.

I have been fortunate in the health of my stock for 33 years, my losses having been very trifling during that long period—no rinderpest, and very little of any other disease.

The question of making fat beef in England profitably is one of immense significance at the present time, and under the threatening aspect of American competition. It is a matter affecting landowners quite as much as tenants, for non-success with the latter means (as at present, after three adverse seasons) a difficulty in letting lands, and in selling them; for, as an eminent valuer wrote to me to-day, would-be purchasers see no security for a certain return of interest in the shape of fixed or improving rents, but rather the other way; and, no doubt, land just now is at a discount. If experienced and successful cattle-feeders, who are amply provided by good landlords with all the necessary appliances and conveniences, see danger, what must be the condition and feelings of those unfortunates who are struggling with adverse conditions and unimproved farms, in addition to bad seasons and fierce foreign competition? Surely the time is at hand when landowners will see that it is to their interest to encourage and attract tenant capital, by the utmost freedom of action, security for tenants' investment, and proper facilities for carrying on their business in the most advantageous manner.

The American Land Surveys have considerably exceeded the estimate which I made some years ago, that the United States had 1,500,000,000 of acres to dispose of, virgin and uncropped and unoccupied soil, whose fee-simple cost would probably not exceed a year's rent and tithes paid by British tenants. I have had very extensive communication personally and by letter with American agriculturists, and have also many volumes, sent to me year by year, of the transactions of the New York State Agricultural Society, and the impression on my mind is that there is a great amount of intelligence, enterprise, and progress in American agriculture. As the farmers nearly all occupy their own land, their mental energy and financial means are quite unshackled and free to enlarge and improve. The mere knowledge that their improvements are their own property, and will be inherited by their widows or children, acts as an extraordinary stimulus to their exertion and progress. The mere fact that no game keeper or stranger dare put a foot on their land, and that the game are their own, adds heavily in the scale of advantageous considerations and independent feeling. Under such circumstances, can we wonder at their rapid increase in national capital and general welfare?

Imagine the feelings of a man who can say, at any day or hour, I will sell my farm and buy another, or add to my farm, or do in any other way just what I like with my own, and compare them with those of a British farmer, who, like that model of a good farmer, the late Mr. Hope, of Fenton Barns, was ousted from the beloved place of his birth and inheritance by a mere after-dinner speech, expressing political opinions opposed to those of his landlord.

These are some of the many causes which alarm capital and forbid its entrance into British agricultural improvement. Long as this preamble is, it has much to do, directly and indirectly, with the fat meat competition question. It looks as if, for the future, Mr. John Bull must change his name to John Mutton, for the latter always is one shilling a stone of 8 lbs. dearer than beef; and we know that, while our American cousins "lick" us in cattle at the rate of 3 for 1, and in pigs at 6 for 1, they have only 25 per cent. more sheep than we have.

So strong was the impression of mutton before beef in the mind of an old friend of mine, a very first-class and money-making farmer of 1,500 acres, that he never had a bullock, but no end of sheep and pigs, and he used to say that a farmer who kept many bullocks need never make a will, for he would have nothing to leave. My friend died worth £100,000, but I was not in his will. I have seen the straw 6 feet deep under his sheep in open yards with sheds.

The American farmers are finding out that 8 tons of maize (40 qrs) whose freights, &c., to England would amount to probably £35, would, when converted into a ton of pork or bacon, only cost £5 or less, for we may reasonably calculate that 8 lbs. of maize would make 1 lb. of pork or beef. They also thus retain all the valuable manure resulting from so vast a consumption of corn. So we need not wonder at the vast and rapid increase of foreign salted meat. The same remark applies in degree to cheese, butter, and fresh meat.

ADVICE TO YOUNG FARMERS.

A young farmer, desirous of storing his mind with the best methods of cattle-feeding, should refer to the numerous and valuable contributions in the Royal Agricultural Society's *Journal* on this subject, by men dependable and well known for their agricultural wisdom and truthfulness, and no doubt an abundance of such useful and needful information could also be obtained from the *Journals* of the Highland Society, the Bath and West of England Society, and the Royal Irish Agricultural Society. A glance at their indices would at once give an idea of the magnitude of the subject. I know of no information more valuable and clear on this matter and on dairy management, than those two papers by the late Mr. Horsfall, in vols. 17 and 18 of the Royal Agricultural Society's *Journal* (first series). A study of them has put money in my pocket, so I can safely recommend them. Read also Dobito, vol. 6; Keary, vol. 9; Karkeek, Lawes, Simonds, and many others, especially vol. 15, 488, C. Lawrence.

MODE OF FEEDING.

This is most important, because it should be regulated by the age and previous condition of the animal. Half-starved store stock require very moderate, and not rich feeding, for all their vessels have been adapted to poor, thin circulating juices, and they are consequently of small capacity, unsuited for rich, thick blood. Norfolk farmers, who go in for lots of cake and corn, will not wait for lean animals, but buy them well fleshed and in good condition, so that good feeding is no novelty to them. A friend of mine—the "mutton farmer," to whom I before alluded—always bought in the autumn high-priced lambs, almost or quite fit for the butcher, and then he could at once feed them on the best of food, and thus fatten his land and his growing animals at one and the same time. Lean stock make starved and lean crops.

The condition of animal voidances is a pretty certain evidence of the results that are being produced. Turnips are either food or physic, according to the quantity eaten. Excessive purgation is inconsistent with fat production. Instead of the usual 8 bushels, from [illegible] to 50 lbs. is all I allow, in addition to other and drier food. Succulent turnips alone cause immense losses in our breeding stocks.

An admixture of cut hay, cut straw, pulped roots, bean or oatmeal, cake, malt culms, and bran with a little crushed linseed or linseed soup is a good mixture. I generally add some condimental food which contains fenugreek. Hay of fine quality is in itself condimental, owing to some of its fine grasses.

My cattle have always access to water and rock salt in lumps in their manger; rock salt is also in our horse mangers.

In covered and enclosed yards there are no draughts. Nothing will give cattle pleuro sooner than a draught of cold air in a warm place. The temperature should be as uniform as possible.

WHY ARE LADIES' LAP-DOGS ALMOST ALWAYS FAT?

Because they are well fed and kindly treated, warm and comfortable, and not unfrequently washed and combed. I know that where cows are groomed daily they thrive. We all know that if they can get access to a haulm wall or a clipped wheat stack, they will groom themselves most heartily and vigorously. I once clipped some cattle on boards, and then brushed them, and they fattened quickly. We are too sparing of a little expense in these matters. Many of those grand specimens of obesity at our great cattle shows are washed and groomed, and carefully and delicately fed. In fact we see their attendants thus feeding them at the show. An ill-tempered, brutal stockman should have immediate notice to quit. A bullock's tongue is a sort of brush or curry-comb, which it frequently uses, but down the back and other parts he cannot reach, and therefore feels truly grateful for a brush or scratch on these parts. Sometimes they oblige each other in this matter.

BEDDING.

This question now becomes, owing to the value of straw, an important one. I hope that the covered and enclosed yard question is now an admitted economical and profitable fact, both as regards landowner and tenant, for it will undoubtedly enable the latter the better to pay his rent. In order to economize both straw and labour, I have for 30 years used sparred floors, both for cattle, pigs, and sheep, very successfully. In the case of cattle the spars should be 3 inches thick and 3 inches wide, and rather less than 1½ inch between each spar, strongly attached to, and supported underneath by rafters. For pigs and sheep the openings must be smaller, say one-half to three-quarters of an inch between the spars, which are of yellow deal. In the case of bullocks they keep clean without any attention to the floors, and of course without straw. I once had 12 white cattle on these spars for 18 months, and they were clean, although not any cleaning had been done to the spars.

The opening or bricked tank under the floor should be from 2 to 8 feet deep. Full details of the boarded floors will be found in vols. 1, 2, and 3 of my book *How to Farm Profitably*, published cheaply by Messrs. Routledge & Sons, Broadway, Ludgate Hill. It is surprising how quickly sheep will fatten on these sparred floors, under cover, but with ample openings in the roof. The pit under them should be at least 2 to 3 feet deep. They do not keep themselves quite so clean as cattle, but pigs do so because they generally dung in one corner, and the urine (which constitutes by far the largest portion of the voidances) passes at once through the openings.

PHYSIC.

A pound of Glauber or Epsom salts is often a very profitable investment—on any symptoms of "non-feeling" or disquietude, a "good clear out" often sets matters right. A stout brother angler was struck suddenly with paralysis while unhooking a fish by my side (most painful to one's feelings); but when we got him to bed, and the doctor came, I asked the latter confidentially what was the first thing to be done in such cases, he replied, "Oh! a good clear out." I was once foolish enough to buy of a neighbour a few starveling juveniles, and I found they would not progress, even with the most careful feeding, and they looked ill—so I killed one and could find no internal disease, and then tried "Epsoms," and a great change quickly took place—for they progressed favourably—we must not forget the farmers' friends, Day, Son, & Hewitt, for their good deeds.

CHOICE OF ANIMALS.

Here again we may compare the human being with the animal. Fat, fair, and forty is a common saying. A well-formed and well-developed frame at the proper age is sure to get well covered if the temper is right, and the countenance agreeable; but a long, gaunt frame, and an uncomfortable and irritable countenance, do not give promise of early obesity. A kindly look and contented disposition indicate farm profits.

Young animals, like young boys, are difficult to fatten; but I manage it pretty well by limiting their opportunity for juvenile activity, and by very good feeding, so that at 18 months to 2 years there is some fat tender beef that wants less hanging than the full-flavoured 4 years olds. Our mutton generally departs fat at 12 to 15 months old. Farm animals, like human beings, should be well fed from their birth, and continuously so, until finally developed. Some farmers need not go to Mr. Banting about their stock, for they know how to take the fat off, or not put it on, judging from the living skeletons which we much too often see in our farms and market under the title of "store stock."

WHY CATTLE ARE LESS PROFITABLE THAN SHEEP.

This is easily explained. On 50 acres of my land, which I am able to sheepfold, I never cart a load of manure; so that there is no straw littering, no carting and dung-heap, and turning and again carting and then spreading, as there must be with cattle in [illegible] open farmyard. Well, then, again there is no waste of manure with sheep, for it all goes on to and into the land, and no part of it is washed out of the farmyard and down the brook when rains fall. But by covered and enclosed yards, with paved floors, cattle can be inexpensively managed, and without the least waste of manure and with a minimum of labour for no dung-heap is required the manure goes at once to the land fit for spreading, and no portion of it is wasted, for the solid and liquid voidances get mixed up into a hodge-podge with the straw by the treading of the cattle. There is no smell or heating until the manure is removed and air gets to it. The quantity of straw required is much less than with the open farmyard, and 10 loads of shed manure are equal in productive power to 15 of the open yard turned-over dung-heap But all this is amply proved and fully dealt with in my books. But remember to use straw very sparingly, so that the mass is always wet and solid—no heating—animals always in good health. They certainly progress much more rapidly, both in growth and fattening, than in open yards. Hairy animals require more warmth and shelter than woolly ones, and should, therefore, not be exposed in the cold months. Mine do well under cover all the year round. Sheep, under cover do not get foot-rot as they sometimes do in the open yards. Urine prevents that. They require much more air than cattle, or they would be too warm.

YOUNG OR OLD CATTLE.

I make most profit from young things carried on gradually to maturity. Under cover, winter and summer, I have often sold them fat at three times their cost in 12 months, or less. They progress under cover much faster than in the fields.

NEGLECT OF VENTILATION

Is a common and unprofitable error. I so often see even new ranges of buildings without openings in the roofs that I call it monetary suicide. I said openings, for one opening will not answer, unless it be divided down the centre so as to make a double tube, in which case the outward and denser atmosphere forces the warmer and lighter internal air through the second opening, so that there is thus a continual gradual circulation. I attribute the sanitary condition of my covered yards and general good health of the cattle to this arrangement of ventilation. It is especially and equally necessary in horse stables. These matters greatly affect farm profits. My losses by stock during 34 years have been comparatively insignificant.

CHANGES OF FOOD

Are dangerous if too hastily made. In spring succulent and watery tares and grasses are mixed with dry hay or straw-chaff, for we bring these home and pass them through the chaff-cutter. An acre of well-podded green beans passed through the chaff-cutter is good and acceptable food for any kind of stock. Dry bean straw when passed through the chaff-cutter and moistened by hot water is better for cattle than any other straw. Science explains to us its nutritious qualities. It should never be wasted under food.

WARM FOOD FOR CATTLE.

Thirty years of experience in this matter has convinced one and all on my farm of its advantage. We usually had 40, and often many more head of cattle, young and old. A closed tank of water was heated by the waste steam, and, as the lad or feeder mixed the cut chaff, bran, malt culms or cake, in the iron tubs sunk level with the floor, and occasional pail of this hot water was thrown on the mass layer by layer, until it was piled high above the rim. The waste steam passing around these iron tubs kept their contents hot. After a few hours the reeking mess was carried to, and spread over, and mixed with the pulped roots, and then placed in the bullock mangers. We could never fat animals so quickly as by these means. It is a decidedly paying operation.

Physically there is little difference between human beings and animals. Warmth, shelter, food of the right kind, and water, administered with regularity, are essentials; and when in confined places, ventilation. We human beings look for our meals at regular periods, and if we do not get them, disturbance by flatulence and other internal derangements are the consequence of this irregularity. So it is with animals.

The next important point is the proportion and qualities of food, and its state of preparation. We can readily see why linseed cake is so generally approved of as food. It combines the nutritious and mucilaginous with the oleaginous, in proper proportions. Bean and pea meal alone are often destructive or injurious. They require a little oiling.

A land valuer told me that he saw a plain farmer feeding his splendidly fat cattle in a miserable old shed and found he was giving them small balls of bean meal mixed into a paste with linseed oil. Here was "practice with science." I invariably mix crushed and boiled linseed as soup with the chaff and other ingredients and the pulped roots, and so we need no choke ropes and have no deaths from "blowing" among our cattle. We never give our cattle more than from 30 to 50 lbs. of pulped roots daily mixed with their other food.

That venerable agriculturist, Mr. Lawrence, justly says the safest course is to mix crushed linseed with pea or bean meal, and he very properly protests against giving to bullocks 150 or 160 lbs of roots daily, or in other words, 16 gallons of water with 1½ gallon of dry food. He found 5[illegible] lbs of turnips a sufficient supply (see Royal Agricultural Society's *Journal*, [illegible] series, vol. 15, page 488). I find that a bushel of pulped roots; mangel especially are excellent food for horses, in addition to their dry food.

THE PROFIT OF CATTLE FEEDING

Must also be indirect. No man, unless he is a farmer, can make a profit by feeding cattle, if he has to pay market price for the food which they consume. Even with pigs, which make the best return, I have seen scores of balance-sheets, or correct accounts of cost and sale, and there has generally been a loss, which can only be compensated for by the value of the manure. But for all that the feeding of live stock on a farm is the best basis of success; and the more that stock is fed with food which was not produced on our farms, the greater and more profitable will be the crops we grow. The misfortune of British agriculture is the small quantity of meat (and consequently of manure) made per acre. Owing to losses not connected with agriculture, I had to reduce my number of stock, and I at once felt their loss by diminished crops and profits. But if our profits on stock-feeding depend on the manure produced, how very important it must be that such manure should not be wasted, but all be applied to the land. This is not, and cannot be done with uncovered farmyards and exposed dung-heaps but it can be, and is done, by covered and enclosed yards with paved floors, from whence the manure is conveyed direct to the land, with all its valuable elements unwasted. Thirty years of my experience has proved this to be correct, and the great crops which I have grown give evidence of the soundness of my practice.

I once asked a Norfolk farmer how he charged his cake which he used to the extent of £1,000 per annum, he replied, "I charge half to the animals and half to th[illegible]nure." My cattle on sparred floors used to give me a quick return; for the manure made one week was washed into the growing crops the next, and in about six weeks I had a grand second or third cut of Italian rye grass. The same remark applied in a degree to my root crops and cabbage.

I am a believer in condimental food and linseed soup as assistants to early ripeness. In former times I used to wean and rear 30 shorthorns annually, getting them from the milk districts of [illegible]cks,* &c., but the cattle plague (which I fortunately escaped) made me change my practice.

How easily the people of this country might be fed with home-grown produce by a much larger investment of capital in meat-making!

AMOUNT OF FAT MEAT, WOOL, AND POULTRY SOLD AT TIPTREE HALL.

1867	£945	10	7
1868	1,541	1	8
1869	1,083	6	4
1870	814	6	6
1871	1,106	8	1
1872	929	10	4
1873	929	13	4
1874	875	17	4
1875	1,018	6	8
1876	936	11	1
	£9,977	17	11
Deduct for lean stock purchased ..	3,019	0	0
Meat actually made on the farm ...	£6,958	17	11

I hope you will excuse all imperfections, as I had only a few days to prepare this paper. I will only add my advice to young farmers to consult the chemist as to the value and quality of both cakes and artificial manures. For every shilling so expended they may save or gain five.

THE GARDEN.

NUMEROUS enquiries reach us regarding the best seedsmen from whom to obtain an annual supply of flower and vegetable seed. We can only say that Messrs. Sutton's supplies to Government and private individuals, have given universal satisfaction.

HYBRIDIZATION OF PLANTS.

ON this subject a correspondent to the *Ceylon Observer* "W. F." writes:—This subject was so ably discussed by Drs. Hooker and Thomson, in pages 21 to 24 of their Introductory Essay to the *Flora Indica*, that I think the whole passage is well worth publication in the *Ceylon Observer*. During rambles in Ceylon extending over about 38 years, I cannot now think of any hybrid noticed by me amongst the wild plants of the jungles, and I am doubtful about their existence. And yet my tutor and guide in my botanical researches since 1850, Dr. Thwaites, leans towards belief in the hybridization of ferns at least, which, as cryptogams with (supposed) concealed organs of fertilization is still more puzzling to me.

At p. 438 of *Enumeratio Plant. Zeyl.* referring to a dwarf and stunted form of the fern *Nephrodium decurrens*, the doctor wrote:—"Hab: Var. B.? Peradeniya, amongst plants of *Aspid pteropus*, Kze., Var. A., and *Acrostichum quercifolium*, Retz. Can it possibly be a hybrid between these two species, bearing, as it does, a certain resemblance to the latter?" My own opinion is strongly against the idea that species of two genera so widely separated from each other in a botanical point of view as *Acrostichum*, and *Aspidium* (Nephrodium-Sagenia) can produce hybrids, for if this idea were once admitted there would be *confusion worse confounded.* I have plants of this supposed hybrid growing now, and I believe it to be a *spot* from its parent plant, and *nothing more.* But as the worthy doctor had an idea that a lately rediscovered small thin fern of Ceylon might be a hybrid, perhaps he has better reasons for his belief in this respect than I have for mine. No living botanist can have greater weight in such profound discussions than the Director of our own Botanical Gardens at Peradeniya.

Respecting your idea of the difficulty in keeping the various *species* of cabbage pure, I believe there is no more difficulty in this respect than in others. Facts well known to cultivators of the common cabbage, *Brassica oleracea*, and referred to in the following extract from Bentham's "Handbook of the British Flora," p. 64, may explain your reference to this family:—"The cultivated forms of this species (*Brassica oleracea*) include the *cabbage, cauliflower, broccoli, kale kohlrabi*, &c., of gardeners." It is not unlikely that these widely varied forms of the common cabbage, may feel inclined to *hark back* to their original, and get "*their selves mixed,*" in the process.

SIMLA SPRING FLOWER SHOW.

THIS Show was held on Saturday afternoon the 8th June, on Mr. Hume's beautiful grounds at Rothney. The weather was unfortunately very unfavorable and must have kept many people away. The following is a list of prize winners:—

Best collections of named varieties of cut roses—Dr. Cunningham.

Best 12 named Geraniums in flower.

1st Prize ... ... Anandale.
2nd " ... ... Mr. Peterson.
3rd " ... .. Mrs. Tytler.

For the best 6 Zonals in flower, named varieties.

1st Prize ... ... Mr. Halsey.
2nd " ... ... Anandale.
3rd " ... ... Mr. Peterson.

For the best variegated leaf varieties.

1st Prize ... ... Mr. Peterson.
2nd " ... ... Anandale.

For the best specimen of any Zonal or variegated leaf variety.

1st Prize ... ... Miss Peterson.
2nd " ... ... Mrs. Tytler.

For the best 12 varieties Pelargoniums.

1st Prize, and Society's medal, Mr. Peterson.
2nd " General Crommelin.

For the best 6 varieties.

1st Prize ... ... Mr. Peterson.
2nd " ... ... Mrs. Tytler.

For the best single specimen of Pelargonium—Mr. Peterson.

FUSCHIAS.

For the best specimen.

1st Prize ... ... Mr. Peterson.
2nd " ... ... Mr. Walker.

PETUNIAS.

For best collection, not less than 6 varieties.

1st Prize ... ... Anandale.
2nd " ... ... Mr. Peterson.
3rd " ... ... " Halsey.

CINERARIAS.

Best collection ... ... Mr. Peterson.

Rare flowering plants.

Best collection ... ... Mr. Peterson.
Best new and rare plant ... ... Mrs. Tytler.

Bouquets made by ladies.

1st Prize ... ... Mrs. Langtry.

Prize given by H. E. the Viceroy.

For the best arrangement of fruit, flowers, or foliage on a dining table ... Mrs. Kerr Innes.

Prize given by H. E. the Commander-in-Chief.

For the best floral arrangement for drawing-room. ... Miss Peterson.

Lady Haines' prize for native gardeners. Won by Mr. Peterson's *malli.* Special prizes for Canterbury Bells, General Crommelin.

ON THE EFFECTS OF HYBRIDIZATION.

(*From "Flora Indica" by Drs. Hooker and Thompson*)

RECENT experiments have led to the following results:—

1. It is a much more difficult operation to produce hybrids, even under every advantage, than is usually supposed. The number of species capable of being impregnated even by skilful management is very few; and in nature the stigma exerts a specific action, which not only favours and quickens the operation of the pollen of its own species, but which resists and retards the action of that of another; so that the artist has not only to forest all the natural operation, but to experience opposition to his conducting the artificial one.

2. Even when the impregnation is once effected, very few seeds are produced, still fewer of these ripen, and fewest of all become healthy plants, capable of maintaining an independent existence: this is a very important point, for under the most favourable influences the average number of seeds that are shed by a healthy plant in a state of nature come to nothing, chiefly owing to the pre-occupation of the soil and the wants of the animal creation.

3. The offspring of a hybrid has never yet been known to possess a character foreign to those of its parents; but it blends those of each, whence hybridization must be regarded as the means of obliterating, not creating, species.

4. The offspring of hybrids are almost invariably absolutely barren, nor do we know an authenticated case of the second generation maturing its seeds.

5. In the animal kingdom hybrids are still rarer in an artificial state, are all but unknown in a natural one, and are almost invariably barren.

On the other hand, it is often argued that hybrids are common in gardens, and that their occurrence in a state of nature cannot be denied; and that if the permanence of one such hybrid be admitted, the whole fabric of species is shaken to its foundation. Such summary conclusions are, however, opposed to philosophical caution; the whole subject is one that cannot be cleared up by a consideration of exceptional cases: it must be argued upon broad principles, and unfortunately no argument has ever been adduced that has not been taken in evidence on both sides of the question. This is especially the case with hybridization, which, in so far as it can produce a form distinct from either parent does, in one sense create what may temporarily pass for a species; and in so far as the hybrid combines the characters of both parents it temporarily obliterates the distinctive characters of each. All, then, that we could legitimately conclude from these facts is, that were hybrids of universal occurrence, they would have obliterated all traces of species, but that, exceptional in art, and not proven if not almost impossible in nature, they cannot be assumed to have produced any appreciable result.

There are, however, other points connected with the subject of hybridity, which are of practical importance to the systematist; and in the first place, the fact of its being generally assumed by continental botanists that hybrids do occur in nature, must not be overlooked. Thus we have so-called hybrid gentians in the Jura, and hybrid thistles in Germany; whence the possiblility of similar productions occuring in India is to be borne in mind. It is however, a singular fact, that these hybrids are vouched for only in general most notoriously apt to vary, and mainly by hair-splitting botanists. In the course of our extended wanderings it has been our habit to acquaint ourselves with the plants as we gathered them, and so to observe their differential characters in the field, that we were always never at a loss for the means of understanding one another when alluding to any particular species; yet we never met with a plant that suggested to us even a suspicion of hybridization. Dr. Wallich, whose tropical experience is probably greater than that of any other botanist whatever, whose mind and eyes were open to seize characters and discriminate species, makes the same remarks. Griffith, a man of singular powers of observation, and whose experience was very great, never alludes to the subject; nor is the existence of bybirds in nature ever noticed in the pages of Roxburgh, Jack, Wight, or Gardner of Ceylon. It is very true that all this proves nothing; but when we add the tacit acquiescence of Robert Brown, and of all other botanists who have lived amid a tropical vegetation, and devoted themselves to its study, it will not be considered surprising that we should suspect such evidence as has hitherto been adduced by local observers only, and in very limited areas.

The subject of hybridzation is however well worthy of the attention of the tropical botanist; and both in his garden and in the field, he should keep his attention always alive to the importance of observing every phenomenon that may bear upon its agency, and should institute operations that will throw light upon the subject.

NOTES ON INDIAN GARDENING.

BY W. H. L.

THE tropical rains are very destructive to newly raised seedlings and fresh sowings—these are uprooted, smashed out—then comes the sunshine and finishes the scene by burning up the bare rootlets! Our *malees* know all this, but they in turn, help to kill by over care; the boxes or beds are smoothered with matting or grass screens—thus *darkness* and *close heat* are substituted for bad weather, and the results are usually the same—a few survivors are tall, thin, pale and degenerate, *plants only in name.* For some time past, I employed a mode of protection, in which all the conditions of light, air and shelter are combined; and it is very simple and inexpensive. I had made up to my order huge hencoop shaped baskets of split bamboo, each about 6 feet in diameter by 4 high; quite sufficient to cover several boxes of sowings; these dome-shaped constructions (very like a dwarf *Kafir* hut) carry off the over-abundant rain, and are easily removed in gleams of sunshine, or during clear weather (always *at night* if possible.) By this system nothing is drowned or yet drawn up, the shade being very moderate. The spot chosen for the operations should be as near the *malee's* house as possible, so as to be within reach during sudden storms. I always go round myself two or three times in the 24 hours, to see that these covers are attended to. Early cauliflowers, lettuces, celery, endive, &c., and many garden annuals were the result of last year's attention to these handy basket screens.

For early marrows, cucumbers, &c., they do good duty against frost by night (always removing them from sunrise to sunset), and where hail storms are prevalent, these cheap protectors will be highly valued by the horticulturist—the price will be about twelve annas to one rupee each, where bamboo is grown—but many other pliant substitutes would be quite as efficient, for instance the willow or tamarix (*jhow* of the N.-W. P.) and several jungle shrubs. During the periods of hot wind, or continued draught, I have used them, covered with common native cotton cloth to shelter groups of flowering plants in pots.

To prevent overthrow by storms of wind, I have two or three loops of thin rope at the bottom, which can be attached to hooked pegs driven into the ground. Horticulture can be enjoyed nearly everywhere, water being procurable. In my Indian wanderings from the Indus to the Berhampooter, I ever extemporised a garden. The first year I dug holes 3 feet deep and 3 feet wide in rows; any worthless soil removed from these, I used in constructing water courses connecting the pits; then I refilled the excavations with earth and any manure, I could collect (not a difficult task in India), these were well irrigated and the soil levelled, and afterwards sown with flowers or vegetables; in the first rainy season following I broke up all the desired garden ground,—the pit, soil and excavations vastly assist the process of trenching and pulverization.

I have even indulged in the above *impromptu* garden, when I lived under canvass, with a "green house" in addition, made of *kutcha* bricks, bamboo and paper, its proper temperature sustained by a flue connected with the clay fireplace I had built to my portable residence, geraniums in full bloom, early plants of marrow and cucumber, many tender plants useful and ornamental, adorned this cheap conservatory, which will be found described and illustrated in an old number of the *Calcutta Agri-Horticultural Society's Magazine.* I have since substituted oiled calico for the paper, as it is more tough and unaffected by rain. Good hand lights are made by forming a circle 2 feet in diameter, of rattan, then three or four rattans are bent and tied to it, over the whole get a tailor to put some course calico, then give a coating or two of the transparent oil varnish.

These cheap auxiliaries for protecting young plants are invaluable for frosty nights and excessive rainfall or hail storms, particularly in the Himalayas, if there were a regular demand our native umbrella-makers would start a new industry. These things I have made to pack up, the semi-circles holding down on the circle are made of Railway fence wire, and the cloth covers, removeable hooked pegs and ties prevent any loss by wind. In the Punjab I found the great necessity of such contrivances—frosts like those of Europe being severe and sudden. The most humble cottage or even hut can be made to look cheerful and picturesque at very little expense in a land where bamboo basket work and labour are so cheap as in our Indian Empire, and where heat, that costly product of horticultural skill, in Europe can be had *gratis*!

A pretty screen is the following. A trough like box is made of old cases and put on roller wheels, rattan or bamboo or better still soft iron wire will make the net work, which can be covered with any show of creepers.

In Europe, Ivy is the favourite plant for these "Leaf Screens," here *Spathadou uncata*—the Passifloras or Ipomœas will all do as well. Being moveable is a great advantage, as they can be adjusted to any position, as required and wheeled about at will; an old worn out native canoe might be utilized in this fashion instead of being turned into a cattle trough.

Orange trees, though the most beautiful ornaments, are rarely seen about our verandahs—they thrive perfectly in tubs, drainage and change of soil being attended to, so do all the *Citrus* tribe. My pattern of tub is this—cut a cask in half, draw a line all round the mouths of the cut halves, 6 inches distant, and with compasses mark off a seal-top pattern, then sawing and rasping will finish them. Nail on stout cross bars, and paint with *coal tar the bottoms outside.*

A tripod stand of roughly cut branches, or bamboos, if the former, they should be painted green, and seasoned about 1½ foot at the bottom by being slightly charred, and then coated with coal tar—to prevent rot and attacks of white ants. I prefer the thick knotty bamboos. These tripods, are made to hold a strong cooly basket of "Tamarix" twigs (called a *Jowah* in the N.-W.) Put a layer of charcoal in each basket; then some large leaves of any kind, spread evenly, fill up with good rich leaf mould, water, and when settled down put in more earth till quite level, again water, and then plant any of the following creepers :—

Ipomœa Mauritanica	Blue
Ipomœa Quamoclit	2 colours.
Ipomœa Japonica	2 or 3 „
Maurandya	„ „
Thunbergia	„ „
Sophas permum	Rose colour
Ipomœa Nil (*Kala dana*)	Blue
Plumbago Capensis	„
Ditto Rosea	Carmine
Calandrina grandiflora	Rose.
Passiflora trifasciata	Red foliage
Ditto Minima	Green do.
Ditto Fœtida	White flowers.
Russellia Juncea	Crimson.
Verbenas	All colours.
Gloxinia	Various.
Achimenes	Various.
Asparagus racemosus	Green foliage.
Convolvulus	Every kind.
Spathodea uncata	Red.
Ferns of handy kinds.	
Clitoria, all kinds	Double and single
Nelana (various)	Blue

to which may be added nearly every climbing and trailing plant of our flower gardens; a large reserve of these baskets should be kept ready sown or planted, so that constant changes may be made according to the season; most of the above will do well in the baskets, and can always be brought forward under slight protection and moderate shade until wanted for the stands. The basket work keeps the roots free from clogging and over moisture (so fatal to many plants in the hands of *malees*)—I raised all my tender annuals, and early vegetables in the Central Provinces by this mode: for rainy climates it is *first rate*, and far preferable to pots, or boxes, which retain too much water. You can hang the basket, too, in your garden border, when a clump of flowers is wanted,—the twig's rapidly decay and serve for manure. I can speak well of this system for India—much time is saved and no losses by transplanting: at the Mauritius they use *Pandanus Vacoi* receptacles in a similar way for their palms and fruit trees, and in Assam the largest cylinders of green bamboo are split in half, then tied and used as a flower pot for coffee, jack fruit, and many other trees when planting out, the cylinder is opened, and the firm mass of soil containing the root, is put into a hole prepared to receive it, thus avoiding all risks of injury.

THE BOTANICAL GARDENS N.-W. PROVINCES.

(REPORT FOR THE YEAR 1877-78.)

WE have to thank Mr. Duthie, the Superintendent of the Gardens, for the early issue of this report, which reports usually do not reach us till the end of the year: Mr. Duthie reports.—

RHEA.—Preparations are being made with a view to the production of a good crop which will be wanted in the autumn of next year for the supply of stems, on the occasion of the competition trials of machines, about twenty acres will be set apart for this purpose. By the direction of Mr. Buck a large portion of the old crop has been dug up, and the roots stored for planting during the rains. This ground, measuring about fourteen acres, is now being temporarily utilised by the cultivation of water melons, &c. The profit realized by the sale of the fruit will help to defray the cost of properly cultivating the crop of *Rhea* above alluded to. This ground had got into very bad order owing to insufficient funds for keeping it well manured and properly weeded; a small portion has already been replanted, and advantage was then taken to follow out some suggestions made by Dr. Forbes Watson concerning the effect of planting at different distances, as well as by the application of different quantities and qualities of manure. Experiments are also being made in order to test the quality of fibre taken from monthly cuttings. A large quantity of dried stems is now in store here.

EUCALYPTUS.—Twenty-eight species of *Eucalyptus* are at present under cultivation in this garden, twenty-two of which were raised from seed during the year under review. The total number of plants in nurseries is about 1,400, and several thousands of seedlings will be ready to transplant during next rains. It is too soon yet to form any definite conclusions regarding the suitableness or otherwise of the climate for each species. Judging, however, from their present condition, the following kinds would seem to be the most promising :—

Eucalyptus bicolor.
„ hemiphloia (dark box).
„ melanoxylon.
Eucalyptus paniculata.
„ siderophloia.
„ tereticornis.

They are of one year's growth and are in a very healthy condition.

A certain number of each kind will shortly be sent to each of the hill gardens under my charge, where good opportunities will be afforded for testing the effect of cultivating them at different altitudes.

Statement showing the number and condition of the Eucalyptus and Syncarpia seedlings in the Saharanpur garden.

Name of plant.	Seed received from.	Seed where collected.	Seedlings in pots.	Seedlings in nurseries.	Height attained (on 30th, March 1878.)	Remarks.
1. Eucalyptus bicolor	Govt. of India,	Queensland,	222	68	3 ft. 3 in.	A distinct looking kind with roundish leaves. It is doing well here.
2. Ditto capitellata	Sydney Botanical Garden.	? ..	Many	..	Less than 3 in.	
3. Ditto conacea ..	Govt. of India,	? ..	..	..	Over 6'.	The seed was sown in Decr. 1875.
4. Ditto coriacea ..	Ditto ..	? ..	..	..	Do. ..	Ditto.
5. Ditto corymbosa	Sydney Botanical Garden.	? ..	79	..	Under 3in.	
6. Ditto ocbra ..	Ditto ..	? ..	20	..	Do.	
7. Ditto globulus	Govt of India, Sydney Botanical Garden.	? .. ? ..	1 47	.. ..	3 in 1 ft.	Maintains its character as a species; all adapted to the climate of the plains.
8. Ditto hæmastoma ..	Govt. of India (sown in April) Ditto (sown in October.) Sydney Botanical Garden.	Queensland. Ditto . N. S. Wales, ? ..	2 33 25 18	.. ..	1 ft. 5. in. Under 3in. 4 in. Under 3in.	
9. Ditto hemiphloia (dark box)	Govt. of India (sown in April) Ditto (sown in October.)	Queensland. Ditto ..	.. 84	102 ..	1 ft. 8 in. ..	
10. Ditto hemiphloia (white box.)	Govt. of India (sown in April)	Ditto ..	..	67	1 ft. 6 in.	
11. Ditto [illegible]	Ditto ditto..	Ditto ..	..	12	1 ft. 4 in.	The plants have narrow foliate leaves
12. Eucalyptus maculata.	Sydney Botanical Garden.	? ..	Many	..	Under 3 in.	
13. Ditto marginata	Govt. of India, Palermo Botanical Garden.	? .. ? ..	.. 10	.. ..	Over 6 ft.. Under 3 in.	The seed was sown in Decr. 1875.
14. Ditto megacarpa	Sydney Botanical Garden.	? ..	15	...	Do	
15 Ditto melanoxylon,	Govt. of India.	Queensland.	..	87	3 ft. 10 in	A broad-leaved species plants very healthy.
16. Ditto paniculata	Ditto .. Sydney Botanical Garden	Ditto .. ? ..	.. Many	13 ..	3 ft. 9 in Under 3 in.	
17. Ditto pilularis	Ditto ..	? ..	35	..	Do	
18. Ditto resinifera	Ditto ..	? ..	12	..	Do ..	Resembles eucalyptus corymbosa (No. 5).
19. Ditto rostrata ..	Govt. of India,	? ..	..	..	Over 6 ft	The seed was sown in Dec 1875.
20. Ditto saligna..	Ditto Lucknow ..	Queensland. Lucknow (acclimatized.)	.. Many	1000 .	3 ft. 6 in . 4 in. .	Originally distributed as eucalyptus resinifera. The plants are doing remarkably well here. Germinated freely.
21. Do siderophloia	Govt. of India (sown in April.) Ditto (sown in October) Ditto . Sydney Botanical Garden.	Queensland. Ditto .. N S Wales ? ..	.. 90 1,145 Many	11	7 in. Under 3 in. Do. Do.	These seedlings are quite different from the N. S. Wales set: probably eucalyptus tereticornis.
22. Ditto stellulata .	Ditto	? ..	28	..	Do.	
23. Ditto stricta .	Ditto	? ..	50	..	Do.	A very distinct looking species with willow like leaves.
24. Do. tereticornis	Govt. of India (sown in April.) Ditto (sown in October.)	Queensland. Ditto ..	.. 44	42 ..	2 ft. .. 3 in.	
25. Ditto viminalis..	Palermo Botanical Garden	? ..	Many	..	Under 3 in.	
26. Ditto virgata ..	Sydney Botanical Garden.	? ..	50	..	Do.	
1. Syncarpia laurifolia ..	Govt. of India Sydney Botanical Garden.	Queensland. N S Wales. ? ..	13 2 20	.. .. ..	¾ in. .. ¼ in. .. 1 in.	Allied to eucalyptus. Is said to be a fine and valuable tree. Extremely delicate here as a seedling, and of slow growth.

CAROB (*Ceratonia siliqua*).

About eight pounds of seeds received from the Director of Agriculture and Commerce last April were sown, some in pots and some in the open ground. The germination of those seeds was most irregular, many of them having lain dormant until now. The seedlings were all transplanted into nurseries last November, and there are now about 1,850 plants, upwards of two feet in height, healthy, and ready for distribution. A plantation of 32 two-year old plants was made at the beginning of last cold weather on an open piece of ground close to where a similar group of *Eucalyptus* was planted. They were put in at equal distances (10 feet apart), and the whole surrounded by a circular fence to keep off cattle. Being a diœcious plant, it is hoped that by grouping them in this way, fertilization may be effected independently of artificial means.

PROSOPIS.—Two species are at present under experimental cultivation in the Saharanpur garden, *viz.*, *Prosopis pubescens* and *Prosopis glandulosa*? like the *Carob* they possess a sweet nutritious pod, much used for cattle-feeding in the countries where these plants are indigenous.

The *Prosopis pubescens*, or Screw Mezquit, is a native of California, Texas, and New Mexico. Two supplies of the pods were received during the year —the first in June, from the Director of Agriculture and Commerce: the second in July, from the Royal Gardens, Kew. The seed was sown at different times both in pots and in the open ground, and there are now hundreds of healthy plants in nurseries.

The other kind distributed under the name of *Prosopis* Sp. is probably *Prosopis glandulosa* or Mezquit of Texas. This plant, in addition to its food-producing qualities, is said to be valuable on account of its hard and durable timber. It also affords a gum resembling gum-arabic. A small bag of the pods was received in July last from the India Office, and the seeds were sown in pots during that month. They germinated in five days. In November the seedlings, which were then upwards of a foot in height, were transplanted into nurseries. They lost all their leaves during the cold weather and seemed to be in rather a hopeless condition. They are now perfectly healthy and growing vigorously, and number about 300

At Chajuri, where some of the seed was sown, there are 150 plants, but in a less forward state.

Euchlæna (Reana) luxurians, a native of Guatemala, is a large fodder-grass which has lately attracted considerable attention in India, and, as far as one can judge from the reports of those who have cultivated it, it is likely to prove a most valuable addition to our fodder-plants. A small packet containing 25 seeds (good and bad) were received from the office of the Director of Agriculture and Commerce in April, and were at once sown in pots. Thirteen of these germinated. When about a foot high they were transplanted to different parts of the garden, so as to vary the conditions of soil, &c., as much as possible. The finest and most fruitful specimens were those which were planted close to the edge of one of the ponds. They threw out numerous side shoots, and ultimately grew to a height of over fourteen feet. The plants were in full flower on 18th November, and gave a large supply of seed during the following two months. The arrangement of the flowers is similar to that of Indian-corn and *sorghum;* the male flowers terminate the stems, and the cobs are developed in the sheathing bases of the upper leaves. It is an annual, but grows easily from cuttings. Sowings will be made this year on a more extensive scale for the purpose of obtaining a large quantity of seed for distribution.

HOP.—Mr. J. Whymper obligingly sent me a few roots of this plant in December last for experimental cultivation, portions of which have been planted at each of the three gardens. Mussooree, from its altitude, would appear to be the most promising place for growing it, but the situation of the garden is hardly sunny enough to bring the plants sufficiently forward, before the rains have set in, after which it has been found that the plants become useless for the purpose required. If this is really the only cause of the want of success which has hitherto attended the trials to cultivate the hop in this part of India, the application of a proper remedy ought not to be an undertaking of much difficulty. The cultivation of grapes at Saharanpur appears to offer a parallel instance, for when the rains are late, the crop is excellent, and this was especially the case last year.

FRUIT TREES.—A very large number of cuttings and grafts are annually made in order to meet the demand for the extensive supply of fruit trees from this garden. The mangoes, peaches, plums, litchis, and loquats still appear to maintain their character for excellence.

Special attention has been given towards improving the quality of the orange by having the trees properly planted and manured Several young plants of a good kind have lately been purchased from Delhi.

VEGETABLES.—The vegetable seed supplied last year by Messrs Sutton and Sons, through the India Office was excellent, more especially the cabbages, turnips, carrots, celery, lettuce, and peas. Much care is being taken in the production, gathering, and selection of good seed for distribution. A second year's experience of English vegetable cultivation enables me to determine which are the kinds most desirable to grow here, and which at the hill gardens. It is evidently wrong, for instance, to sow for seed such kinds as habitually produce no seed the first year, as these plants are unable to survive the hot season; and there are many kinds, such as radish, which produce very indifferent seed in the plains or very soon degenerate.

IMPROVEMENTS.

The felling of trees in overcrowded places and the transplanting of shrubs have been carried on extensively throughout the garden during the year. Having obtained the consent of His Honor the Lieutenant-Governor to expend a certain portion of the money realized from the sale of timber on useful improvements, the following works were undertaken as being the most necessary for the good of the garden, *viz.*—

(1.)—Drainage.
(2.)—Levelling and trenching land.
(3.)—Clearing jungle.
(4.)—Repairing roads.

I have much pleasure in stating that the drainage system throughout the garden is now in a most satisfactory condition, the effect of which can hardly fail to prove most beneficial in every way, practically as well as adding immensely to its ornamental appearance. Formerly during the rainy seasons large portions of the garden were continually under water; degeneracy and proverty were consequently the conditions of much that was attempted to be cultivated on such a water-logged soil.

New nurseries for economic plants have been made this year on a piece of ground where some of the *Rhea* crop was formerly cultivated. They already contain a large number of valuable and interesting plants, such as *Eucalyptus Carob, Prosopis*, &c.

The nurseries for useful timber trees are still kept up, and large additions are made annually by fresh sowings. The flower garden has been greatly improved by adding a piece of ground which was formerly useless from being undrained; this latter has lately been well trenched and levelled. The whole piece when grassed and properly laid out in beds will be utilized as a flower garden with the special view to the production of good seeds for distribution.

DONATIONS.

DONATIONS OF PLANTS AND SEEDS.—In the list of contributions appended below in detail it will be seen that an unusually large number of valuable and interesting plants have been received during the year. Special thanks are due, therefore, to those who have been the means of so richly adding to the value of these gardens.

The Australian seeds, especially those from Queensland, are likely to do well in this climate. Dr. King, Director of the Royal Botanical Garden, Calcutta, continues to be a liberal contributor. His collections from the Sikkim Himalayas including a great number of rhododendrons, will be of much use at the Mussooree garden, as also the large collection of eastern European seeds sent through him from St. Petersburg.

The plant called *Nymphæa Pygmæa*, received from Dr. Aitcheson, and collected by him in Cashmere, is one of great botanical interest. It is a kind of water-lily, and was known previously in India only in the neighbourhood of the Khasia hills. A root of it was sent from here to Sir Joseph Hooker, and news has recently been heard of its safe arrival at Kew. The plant is doing well in one of the ponds of this garden, and will probably be in flower in a short time

A large box of sweet chestnut seed collected in Sicily was most obligingly sent to me by Professor Todaro, the Director of the Palermo Botanical Garden. The seeds arrived on the 4th of March in excellent condition for immediate sowing. All those that were not in a too advanced state of germination were immediately despatched to the Mussooree garden; the rest were sown in a cool place in this garden. Many of them have come up and are doing well. I attribute the secret of their satisfactory condition on arrival, to the fact of their having been packed without the removal of the outer prickly cases. The seeds also were very fine ones, and were probably picked just at the right time.

ADDITIONS AND DONATIONS TO THE MUSEUM.

A valuable collection of vegetable products chiefly from this part of India has recently been added. It formed a portion of those that were brought together to represent the Indian raw products at the Paris International Exhibition about to be opened.

The number of visitors during the year was—

Europeans	1,261
Natives	4,307
Total ...	5,568

being an increase of 1,479 as compared with last year.

TRAINING OF FORESTERS AND MALIS.

Since the resignation of my predecessor, Dr. Jameson, the connection with the canal department has been limited to a certain annual supply of timber seeds and *Agave* plants, and the occasional appointment of a forester to superintend nurseries and plantations. I have already mentioned in my report for 1876-77 the advantages of this garden as a means of acquiring education and practical instruction in arboriculture.

Owing to the increase of gardens in India, both public and private, there is now a larger demand for *malis*, and in order to develop the usefulness of this establishment for the supply of these men, arrangements are being made for giving them more general instruction than has hitherto been the custom. During the year eight *malis* have been appointed to take charge of gardens in different parts of India.

MUSOOREE GARDEN.

The chief work undertaken during the year has been to increase the stock of useful trees and shrubs. A large piece of jungle has been cleared in order to make new nurseries for timber and fruit trees, as well as for the more extended cultivation of English vegetables for seed, especially of such kinds as are less successfully grown in the climate of the plains.

There will be a large supply of sweet chestnut seedlings for distribution next year.

Twenty-three kinds of *coniferæ* are growing in the nurseries, including eight Himalayan species, several of which will soon be ready for transplanting.

Efforts are being made to form a good collection of economic plants suitable for the climate, and which would in fact be a supplementary one to that of Saharanpur

The annual destruction of fruit by storms of hail, during the early summer months, suggests the advisability of adopting a mode of training, 'espalier' or otherwise, which will admit of their being more easily protected on these occasions. There are some very good kinds of apples, pears, and plums, for instance, the fruit of which is almost every year either entirely destroyed or very much injured.

The conservatory is still in an unfinished state of repair, and the preservation of its contents during the cold weather and rains is a work of much difficulty.

CHAJAURI GARDEN.

This garden is now getting into a much more satisfactory condition. All the jungle growth within the culturable boundary has been cleared away; old or useless fruit trees have been removed, and the remainder pruned and properly manured. There is now plenty of land available for nurseries and for the experimental cultivation of useful plants.

By the appointment of Colonel Chamberlain's gardener from Ranikhet as overseer, it is hoped that good results will be forthcoming, more particularly towards the improvement of vegetable seed. The quality of last year's supply from England was excellent, as has already been mentioned, so that a good start will have been made. There are many advantages in favour of this garden ultimately becoming the head-quarters of vegetable cultivation for the distribution of seeds.

The path towards Mussooree, up to the point where it joins the road to Chakrata, has been put into good order, and the garden is now accessible by ponies. I may mention that the overseer of these gardens deserves credit for the efficiency of the work.

In conclusion I have to state that, in consequence of the death of Mr. Nisbet, the late head gardener, I have been deprived of much assistance, and the additional amount of routine work which I have now to perform gives me very little leisure for pursuing subjects of scientific interest. It is unnecessary here to repeat the other reasons, elsewhere stated by Mr. Buck and myself, regarding the expediency of appointing a good European gardener in the place of Mr. Nisbet.

I must not omit to express my acknowledgment of the help and encouragement I have received from Mr. Buck, Director of Agriculture and Commerce, North-Western Provinces and Oudh, both by his valuable advice and the active interest he has taken in the working of these gardens. The Parsi draughtsman has been working here steadily since his appointment from January, 1877. He has been chiefly occupied in the preparation of drawings to illustrate Indian agriculture. He has made considerable progress during the time he has been here, and seems to take a real interest in his work.

FORESTRY.

ACCORDING to the report of Lieutenant-Colonel Beddome, on his recent tour of inspection of the Anamally Forest in Madras, it appears that the working of the forest, during the last half of the year 1877, has not been satisfactory in a financial sense. Since the year 1869-70, when fair profits were realised, there has been a deficit every year, except 1871-72 and 1873-74, In 1876 77 the expenditure was Rs. 47,533 against a revenue of only Rs. 8,491. According to Colonel Beddome's report considerable reform is required in the management of the forest.

THE cultivation of the caoutchouc-tree seems to be progressing in Assam. Extensions amounting to 120 acres, were made in the plantations at Charduar and Kulsi during 1876-77. The growth of the trees is said to have been satisfactory in both places, though considerable damage was done to them by deer. A new nursery for raising young trees, both from cutting and seed, was prepared in the Charduar plantation, and the number of young trees raised during the year was 8,018 from seedlings, and 3,052 from cuttings. In the cultivation of exotic species of the tree, the Forest Department was, however, not so happy. Thirteen plants of the para-caoutchouc were received, but they perished without exception, and it is supposed that the climate of Assam is too cold for the foreigner.

IN communicating his observations on the proceedings of the Government of India in the Forest Department, for August and September last, the Secretary of State has, we are informed, called for further reports relating to the cost of sleepers supplied to the Indian State Railways from different sources It appears that in the recent reports, no information was furnished as to the place where delivery of sleepers was in each place taken, nor as to the relative qualities of the sleepers supplied in India by the Forest Department, and by contractors respectively; but it would appear from the particulars given, that sleepers obtained in the open market from contractors, are generally lower in first cost, than those supplied by the Forest Department, and that saving those purchased for the Tirhoot State Railway, the creosoted fine sleepers from Europe are cheaper than any obtained in India and cut from native grown timber.

THE latest number of the *Indian Forester* is interesting as usual. The "Notes on Sandal," by "Kad Handi" raise questions deserving examination and reply. In Mysore, the growth of sandal is a Government monopoly, and has been so from time unknown, but its growth has been left to nature alone. Remarking its extreme tenderness, Kad Handi holds that scientific culture would pay better. Trees are worthless till their heart-wood has developed, but—

> "Sandal grown in exposed situations yields a heart wood generally only of use for burning and distilling. Natural reproduction has been much reduced latterly, and may be expected to be more so in the future. Taking the province through, the greater part of the fine carving wood is produced in the numerous patches of garden land—'nut topes,' in country-bred phraseology,—studding the face of the plateau; if the supply is to be kept up, plantations must be made, and, sites and other conditions being under control, none but first class wood need be produced in them: the production of sandal wood being purely a question of revenue."

The marked maturity of the tree is judged to be as soon as possible after the formation of the heart-wood. Under medium conditions it is computed that—

> "The crop value of a fully-stocked sandal plantation cut at 40 years, supposing it at that time to contain 100 mature trees per acre of a net value of Rs. 30 each, will be Rs. 3,000, per acre."

The evidence upon which the writer makes these calculations is not conclusive, but that we must leave others to discuss. The points he wishes to prove are these:—

1. That scientific cultivation is advisable.
2. That the demand for sandal wood in England and on the Continent, is inexhaustible.
3. That the growth of sandal in suitable parts of India, of which there are many, would repay 10 to 11 per cent. on the original outlay.

We shall not express an opinion upon any of these points, but they would seem to deserve investigation. Our space will not allow of a more lengthy review, but we would remark that the articles upon the *eucalyptus* of Australia, the need of their introduction into Algeria, and the success and beneficial results of their growth at Abbottabad, in the Punjab, should be of interest to professional and scientific men.

THE administration Reports of the Forest Department of the Bombay Presidency for 1876-77 have been lately submitted to, and received by, the Secretary of State. His Lordship is of opinion that a great deal yet remains to be done in the Bombay Presidency in the reservation of Forests areas, and desires that fuller particulars may be given in future Reports as to what has already been accomplished in this respect, and the bearings which the resources have with regard to situation and extent, to the general requirements of the country. It appears that owing to the drought the progress of demarcation was not carried on so rapidly as in former years. 2,142 square miles were added to the reserves in the Northern and Southern Divisions; but at the same time 1,794 acres in Sind were lost to the Forest Department owing to the excess of deluvion over alluvion. The extent of the reserves in Sind amounts to 243,325 acres, or 536·4 square miles, but it does not appear from the Reports, what extent has been reserved in the rest of the Presidency. The net receipts of the year amounted to Rs. 3,94,333, being Rs. 70,193 less than was realised in the previous year. This was partly owing to decreased receipts mainly to increased expenditure. The Forests were extensively made use of during the season for the purpose of pasturage, and the value of cattle whose lives were saved by this means during the period of drought was considerable. In receiving the Proceedings of the Madras Government in the Revenue Department (Forests) for April 1877, the Secretary of State makes the follow- important remarks:—

> "The subject of firewood plantations in the Madras Presidency is one of considerable importance, and, as railways are extended, the question of how to provide an adequate amount of fuel in order to meet the increased demand for it that will necessarily arise owing to the absence, so far as is at present known, of any workable coal deposits in Southern India must sooner or later, engage the serious attention of our Government. The report contained in your proceedings refers to the state of the fuel reserves and plantations three years ago and is therefore valueless as representing their present extent and condition. The general question as to the extent of firewood and reserves necessary to be maintained to meet the requirements of the Madras Railways was fully considered by your Government in 1870. Directions were given * * * for considerable extensions to be made to the then existing reserves, and I desire to be informed how far the additions since made, have kept pace with the increasing requirements of the country."

MADRAS FORESTS.

IN his remarks on the Report of the Conservator of Forests on the administration of the Forest Department of the Madras Presidency for the year 1876-77, the Secretary of State expresses his concern at the condition of the Madras forests arising from the process of rapid denudation, to which various causes have of late years given an impulse The subject of forest conservancy in its bearing on the calamities which arise from floods and famine is deemed by the Secretary of State so serious and important, that he has dealt with it at considerable length in a separate despatch to the Government of India. The rapid extension of denudation in Madras, is apparently universally acknowledged, though it is a matter on which it is difficult to obtain precise data. The demand for fuel, both for working the railways and for the construction of public works, the opening out of coffee and other plantations, and the extension of ordinary cultivation, are among the influences which give rise to the evil complained of. Sir Richard Temple indicates the probable result of a clearance of forest for railway demands in Madras, in the aggravation of the evils which are already familiar in regard to the Palar river, from the waters of which an extensive series of tanks for irrigation in the districts of North Arcot and Chingleput derive their supply. "Seldom" he writes "does the river descend in seasonable and propitious floods, One year it will come down with violent "inundation, demolishing its dams; tearing up its banks; "another year will leave them all high and dry." This case is adduced as a type of what is frequently going on in many parts of the country, and which is to some extent attributable to the denudation of forests. Ample evidence of the effect of the growth of wood on the conservation of springs is found in works such as those of Dr. J. C. Brown and of Mr Marsh, the American Minister at the Court of Italy. The latter a careful observer and collector of facts bearing on this and kindred subjects, remarks that "the general truth that the flow of springs and "the normal volume of rivers, rise and fall with the extension and the "diminution of the woods where they originate and through which they "run, is as well established as any proposition in the sphere of physical "geography." The works of these authors also contain full information in reference to the satisfactory result of operations for the restoration of tree growth on slopes in several of the departments of Southern France, which had most severely suffered from the effects of denudation in producing drought and flood. The facts are referred to in a paper by Colonel Pearson, which is printed in the appendix to the Report of the Forest Conference held at Simla in October 1875. On the whole the subject is one which seems to demand more earnest consideration than it has yet received, except from a few individuals. The steps already taken to remedy the evil are insignificant, and the Secretary of State thinks that what is now required, is a declaration of the necessity to provide for the conservation of forest growth on a much larger scale, and probably at much more frequent intervals than has yet been undertaken, with a distinct view to its action on the maintenance of springs, and as the natural regulator of the escape of moisture from the soil. Although these remarks bear especial relation to the circumstances of Madras, there can be, no doubt that the principles involved, call for application in many districts in India. The Punjab Forest Report of 1875-76, for instance, shows how lands on the upper courses of the Beas, the Ravi, and the Chenab were then rapidly deteriorating owing to the reckless destruction of forests. In a separate despatch, communicating his remarks on the annual reports of the Forest Department, the Secretary of State further points out that in none of these reports, excepting those of Hyderabad and the Central Provinces, is any reference made to the record of meteorological observations in connection with forest conservancy. It seems desirable, His Lordship thinks, that some systematic attempt should be made to record, upon one uniform basis, any climatic effects that may be produced by the operations of the Forest Department, and particular notice should also be made of the physical changes produced in rivers in consequence of the extension or decrease of forest areas within their water-sheds. The possibility of establishing observations of this nature is recommended to the consideration of the Government of India.

FOREST CONSERVANCY IN THE DECCAN.

THE following minute by His Excellency the Governor appeared in the *Government Gazette* :—

"The need of regularity in the supply of moisture and water in the Deccan has been brought into such prominence by the drought and famine of 1877 that I need not attempt to describe it.

But, together with my honorable colleagues, I have been forced to consider the relation which the preservation of forests, jungle and vegetation may bear towards this subject.

Whether it be certain or not that forests affect the regularity and the distribution of the annual rainfall (though probably most people believe they do, which belief is shared by myself and my colleagues), it is certain that they do affect the supply of moisture and water in the country generally, and especially the many rivers which traverse the Deccan from the west, in a direction either easterly or south-easterly. From this point of view all considerations concerning forests, jungle and vegetation become grave; but they acquired additional gravity when we have undertaken, or are about to undertake, a system of irrigation works dependent on these rivers.

I need not enter upon the considerable results which have been already attained by forest conservancy in the Bombay Presidency during recent years, nor touch upon the national wealth in wood and timber which has been thus preserved for the public benefit. I will restrict myself to such suggestions as concern climate and water-supply, and to particular matters in which further improvement is unquestionably desirable and practicable.

I bear in mind that if we attempt to bring under forest or jungle any considerable area beyond that which we already have, we must be careful not to interfere unduly with the rights and the requirements of the rural population, which, despite losses occasionally from drought, disease and scarcity, is increasing and pressing upon the culturable, land. It is also to be remembered that many pieces of land which we might desire to see under forest have been awarded to the villagers under a land revenue settlement which must be preserved inviolate. Such pieces, therefore, can be acquired only by purchase under the law, or by exchange, or by special arrangement.

Still I believe from what is to be seen, heard or asscertained. that the District Collectors, in conjunction with the Forest Officers, might manage to improve or preserve the vegetation in many localities, which are specially important in reference to climate and water-supply, without trenching on the rights or requirements of any one. And, adverting to this, I have to record for the consideration of my honourable colleagues certain observations in detail.

These observations will refer only to Khandesh and the Deccan—and not to the Southern Deccan, nor the Konkan, nor Guzerat. The principles to be indicated probably are applicable to all parts of the Presidency alike. Still the following observations are directed to the local peculiarities of the Deccan.

The points to which additional attention should be directed seem to me to be the protection of the forest, the jungle and the vegetation,—*firstly*, on the water-shed line of the Sahyadri range, commonly known as the Western Ghats; *Secondly*, on the springs, sources, and head-waters of the rivers which spring from that range; *Thirdly*, on the top ridges and upper slopes of the cross ranges of hills which branch off eastwards from the main range of the Sahyadri.

As regards the first point, the water-shed which really divides the Deccan from the Konkan is always to be traced as a clear line of physical geography. Indeed, it is the most important and remarkable line in this part of India. It varies much in altitude in different parts of the Sahyadri range. Sometimes it ascends over lofty bluffs, 4,000 feet high and upwards, sometimes it descends into dips and gaps, 2,000 feet high. It is traversed in two of these gaps (the Bhor Ghat and the Thal Ghat) by lines of railway. But it never fails to be easily discernible. And it is spoken of by the hill-people as the 'Ghat Matha.' It supplies the sources of all the rivers that flow eastwards through the Deccan. It is naturally clothed with forest and undergrowth, preserving the moisture which is ultimately to feed the river-sources with water. For the sake of these rivers, then, and of all the great interests depending on the rivers, it is necessary that the vegetation, trees, and brushwood on the ridge of the water-shed, and on the steep side on the eastern slope especially, should be most carefully preserved. The western slope may be indeed of equal importance; that, however, affects the Konkan; whereas it is the Deccan which we are now considering.

To some extent this preservation, indeed, exists already. Many parts of the water-shed, as above described, are included in the Government reserved forests. But these reserved forests are in some places well supervised, while in other places the supervision has become from various causes almost nominal. Some parts of the water-shed again are given out to grazing; while some few parts are occupied by a sort of rude cultivation. It should, I submit, be our object to render this supervision complete and absolute all along this limited line. The several Collectors in conjunction with the Forest Officers, should be instructed to examine the line, as far as it lies within their several districts, and to ascertain exactly how it can be brought under the sort of supervision which is desired.

If we begin within the Deccan, from the south, above the northern boundary of the Kolhapur State, proceeding northwards, that is, about the source of the Warna in the Satara District, the water-shed line will, I am informed, be found tolerably well clothed with vegetation up to near the source of the Koina, the line falling within tolerably well-kept forests belonging to Government. The attention of the Collector of Satara should be specially drawn to this section of the water-shed line; and if its vegetation be as well preserved as I understand it is, it may serve as a model for what the rest of the line within the Satara district ought to be. And as the Collector (Mr. Moore) takes a just interest in this subject, he will doubtless profit by that experience. Near the source of the Koina, and near the adjacent source of the Yenna and of the Krishna, the water-shed line is under a sort of supervision, which, such as it is, comes under the personal observation of us all as we sojourn at Mahableshwar. The supervision is nominally an organized affair; in practice it is very defective. Often close to the very water-shed, jungle fires are lighted up, rude cultivation is permitted, and cattle eat down whatever young trees strive to spring up. The fires can and doubtless will be stopped; there are other grazing places below the water-shed which can be assigned to the cattle; and by degrees the occupancy rights on the water shed, which are comparatively few, can be bought up or exchanged for other lands. Arrangements for the better preservation of the vegetation on this section of the water-shed have already been made, and will doubtless produce results.

Next, there comes, as we still proceed northwards, the section of the water-shed within the State of the Pant Sachiv, supplying the sources of the Nira and the Mutha rivers. The vegetation in this section is, I am informed quite unprotected and for the most part destroyed, though caple of rapid restoration. For such restoration it will be necessary to make some special arrangement with the Pant Sachiv, who is under the political control of the Collector of Satara.

Then, there comes the section within the Poona district, supplying the sources of the Mula, the Indrayani, the Bhima, the Ghod, the Kukari. In a part of this section the vegetation is well preserved as we all see when we pass by the railway over the Bhor Ghat. The remainder is, I hear, tolerably well preserved, though doubtless it may be much improved, if the Collector, Mr. G. Norman, will give his particular attention to the subject.

Next, there is the section of the water-shed within the Ahmednagar district known as the Ankola Ghat, whence rise the streams which virtually are the sources of the Sina. In this section the vegetation is, as I understand, well preserved, though its growth is susceptible of much improvement. If this be so, its conservancy may serve as a model to other districts.

Then follows, still in a northerly direction, the section within the Nasik district supplying the sources of the Godavari and some of its affluents also of the Girna. In this section of the water-shed the vegetation is indifferently preserved on the eastern side, as we all see when we pass by railway over the Thal Ghat. Indeed, I learn that some part of this section is almost denuded. We must bear in mind that hereabouts there dwell the Bhils and other hill-tribes who live entirely in the forests, and whose wants must be supplied while their rights are respected. Still for the safety of the Nasik district generally, it is necessary that the limited line of the water-shed should be let alone by the hill-people in order that it may be overspread with its growth of vegetation. If the Bhils have holdings on this limited line, they can go to other lands in exchange, either for culture or for pasture. If the Collector will give his attention to the matter, he may by good management make some arrangement with the Bhils, whereby this particular piece of of the jungle may be preserved.

Lastly, there comes the section of the water-shed in the taluka of Pimpalner, in the Khandesh district, supplying the source of the Panjara river. Here, as I understand, the vegetation is not preserved at all; the ridge itself being mostly occupied by a sort of rude culture belonging to the Bhils. But considering that other ground might be given them in exchange, that the Bhils easily move about, being of migratory habits, I should not doubt that the Collector, Mr. Propert, could, by applying to the subject his large knowledge and experience, some arrangement whereby this limited line might be given up to jungle without any trouble being caused with the Bhils.

As regards the second point, namely the springs, sources, and head-waters of the rivers, I have found water-springs of frequent occurrence wherever I have marched near the ridges of these mountains, and I am informed that such springs are traceable everywhere near the tops of the mountains, that is wherever the formations of laterite and trap permit the moisture to percolate from the summits and to break forth in springs of water a short distance below. I have written above '*traceable*,' because if the surrounding vegetation is wholly preserved, the spring sends forth running water; if the jungle is imperfectly preserved, the water only oozes or trickles out; if the jungle is almost destroyed, the spring is found almost dry. The same circumstances affect similarly the head-waters of the rivers. Now, in the same manner as that already indicated respecting the water-shed line, the Collectors in conjunction with the Forest Officers, may make local arrangements for preserving the vegetation near the sources of the rivers.

Beginning as before from the south, I understand that the vegetation near the source and head-waters of the Warna is comparatively well preserved, better perhaps than in the case of any other river. Near sources and head-waters of the Koina and the Krishna the vegetation is, as we all see, while residing at Mahableshwar, partially preserved. But certainly the sources of the Krishna are not nearly as well protected as they ought to be in reference to the extreme importance of that river to the welfare of the country. The sources of the Yenna being almost in the station of Mahableshwar, are, of course, remarkably well preserved by an artificial lake surrounded with woods, but after the river leaves this neighbourhood, and falls over a long rocky scrap, the vegetation near its stream is, I fear, neglected.

Then the sources of the Nira and the Mutra (in the Pant Sachiv's State), are, I fear, almost entirely neglected, which is a matter for grave consideration, inasmuch as both these rivers are depended upon for the supply of water to extensive works of irrigation, recently constructed or extended.

In the Poona and Ahmednagar districts the vegetation near the sources of the Mula, the Bhima, the Indrayani, the Ghod, the Sina, is reported to be tolerably well preserved. Still the Collectors of those districts would do well to see whether the good already done by preservation of jungles cannot be consolidated and still further augmented.

In the Nasik district the vegetation near the sources of the Godavari and its affluents is reported to be very indifferently preserved. Indeed, as we all see, the low state of the Godavari river at and near Nasik during the dry months, affords evidence unmistakable of denudation of jungle near the source. This thoughtless wasting by the people, of the water-supply, through their their neglect of the jungle, from which loss they are themselves the first to suffer, demands the serious attention of the district authorities.

The source of the Girna is somewhat better cared for, though here much improvement is required, as upon this river the irrigation works of Khandesh depend for their water-supply.

The sources of the Panjra are perhaps less important than in the case of some of the other rivers, but they appear to be practically without supervision, and have only such vegetation (so I learn) as chance may leave to them. If this be so, then the point requires the special consideration of the Collector.

As regards the third point, namely, the top ridges and upper slopes of the cross ranges, which branch off eastwards from the main range of the Sahyadri, we all see that these must all have been once clothed with vegetation, though they are now bare. Nevertheless, we know partly from general experience and partly from special experiments, that they might be re-clothed gradually. If their jungle and vegetation were even partially restored, such restoration would improve the climate and water-supply of the Deccan, and would preserve some water in many of the affluents of the main rivers. They may be described (beginning as before from the south) as the Mula Ghat separating the Warna from the Koina, the Mahableshwar range overlooking the Yenna, the Panahgani range over the Krishna, the Khamatki range bounding the N · a valley, the Sinhgarh range near Poona, the Harischundra range forming the boundary of the Poona and Ahmednagar districts, the Kalsubai range forming the boundary between the Amednagar and Nasik districts, and the Sapta Shring range north of Nasik; also the two ranges which separate the Sholapur district from the Nizam's territory on the north, and the Satara district on the south. With the exception of the Mala Ghaut range, and some places in the other ranges such as Sinhgarh and the Katraj Ghat, they are destitute of vegetation. Cultivation spreads, and must necessarily exist, up to their very base; it generally creeps up the lowest portions of their sides. The people have grazing right in nearly all parts of them. The Government, however, has some rights too, and there are often waste lands at its disposal. By judicious arrangements; by ensuring that by rotation the people shall always have some lands for grazing and some lands for wood-cutting, while a sufficiency of jungle is preserved by keeping cattle out of some jungle while the vegetation is young; by letting them into other jungle when the vegetation has become strong; by taking up some occupied lands in exchange for others; by buying up some lands, by turning deserted lands into forests, and so on,—the Collectors may, by diligent and vigilant attention, be gradually able to bring under vegetation once more such portions of these hills as are important on climatic and other material considerations. The success which has followed the establishment of belts of forests along the banks of the Bhima and other rivers in the plains of the Deccan, is an earnest of what may be attained in the low ranges of hills, if the Collectors will lend their earnest attention to the matter.

I should desire to address these observations (if my honourable colleagues shall concur in them,) especially to the several Collectors. The Forest Department may do, and doubtless will do very much. But full success will not, indeed cannot, be secured unless the Collectors give to the Forest Administration the weight and the benefit of their knowledge, experience and authority. If we are convinced of the importance of forest and jungle in respect to the matters described in this Minute, we have a right to invoke the services of the Collectors and their subordinates for the furtherance of these matters as much as for any other matters of district administration. For the general guidance of the Collectors in all these respects, we may depend on the zeal and ability of the Revenue Commissioner, Mr. E. P. Robertson.

The district authorities will, I am sure, receive all requisite assistance from the professional skill and co-operation of the Forest Conservator of this division, Mr. A. T. Shuttleworth, and his assistants.

The Indian Forest Act of 1878, which has just come into force in this Presidency, will greatly facilitate all proceedings which may be taken in accordance with the principles which I have endeavored to explain above.

The Collectors may, we know, be trusted to protect all private rights in the lands which may be, for the public good, brought under forest conservancy; and to arrange that all the reasonable requirements of the people in the jungles shall be satisfied.

I am aware that as our area under conservation shall increase, and as the conservation itself shall become more and more complete, additional establishments will be required. But as our forest income and the financial proceeds of our conservation shall be augmented, there will be a good case for augmenting the establishments. And I shall be willing to consider favourably and practically any proposals which my colleagues may offer in this respect.

RICHARD TEMPLE."

The Planters' Gazette.

TEA.

RED spider is still very prevalent in the Darjeeling district, and is doing serious injury to more than one of the gardens.

ACCORDING to the latest accounts from Nepal, dated the 28th of May, the harvesting in the valley goes on quickly, the weather gets more open, and prospects are good.

IN consequence of the exceptionally unfavorable weather at Darjeeling last month, the outturn from the district was very far below the estimate, and it is doubtful whether the deficiency can be made up.

DURING the week the weather has been peculiarly favorable to tea, and many of the hill gardens at Darjeeling are making a considerable amount of really good tea. There is at present every prospect of most gardens doing very well this month.

THE Darjeeling paper says that red spider has been very much on the increase amongst several of the hill gardens during the last fortnight (20th June). It is to be hoped that the rain will put a stop to its ravages, as it certainly has done a great deal of harm, by retarding the flush wherever it has made its appearance extensively.

THERE is a famous flush of tea here, says a Kulu correspondent, a little sun after all the wet we have had will soon bring out the leaf. What a difference careful management makes, one tea garden in the Kangra valley paying 15 per cent. and another older one, not far off, only 2½! I hear the shareholders of the 2½ per cent. talk of interviewing the management generally.

WHEN tea was first planted in the Darjeeling Terai, it was considered the most deadly spot for Europeans in India, and with some reason, as the place was one mass of dense jungle. Since then, the jungle has been almost entirely cleared away, and yet the mortality amongst Europeans has increased at the rate of about a hundred per cent. within the last two or three years according to the *Darjeeling News*.

A CORRESPONDENT writes from the Kangra valley in the first week of June :—

The snow lies unmelted on the hills, and the nights are cool and pleasant. Since my last letter, we have had yet another hailstorm which cut up the Nassau, Holta, and Baree Company's gardens. With commendable impartiality the element has now paid a visit all round. The mention of "outturn up to date" makes one shudder, for the decrease on last year may be fairly estimated, I think, at about 33⅓ per cent; while the tea that has been made, leaves a vast lot of room for improvement. The gentleman who assesses us for the new license-tax should have a sinecure berth. The wheat harvest, which promised so well, met with bad luck. From the 11th to the 28th ultimo, we had nothing but cold; rain alternately swelling into a deluge or sulking into a sort of Scotch mist. It happened that a good deal of wheat was out and lying out on the terraces of the fields, and the wet has damaged it considerably. Owing to the failure of the rice last rains, the zemindars (or ryots' as you would call them down country) have been counting upon the *bhurreef* crop, and they have little or no food left in their houses. Much of the wheat has sprouted in the ear, and when, at no very distant date, it goes the way of all flesh, there will, I am afraid, be a considerable amount of sickness. Rice is selling at 9 and wheat at 10 seers for the rupee, while gram is a far too expensive luxury to give to horses, who will have to put up with the not very satisfactory substitute of barley.

KINMOND'S TEA DRYING MACHINE.

(*Darjeeling News.*)

MR. KINMOND has patented a combined tea-drying and leaf-withering machine, for which he claims the following advantages. His machine will dry tea in one-fourth the time of that required by the *choolah* system when the same quantity of heat is being used by both, and the heat may be derived from any kind of fuel. Mr. Kinmond's full-sized machine occupies a space of 7 ft. 6 in. long and 3 ft. wide and will dry 30lbs. of tea in seven minutes, and allowing one minute for changing two trays. in each drying chamber will work off 28 maunds of tea in ten hours Mr. Kinmond says that to dry this quantity, the *choolah* system requires 44 maunds of charcoal against 20 maunds of fire wood, or at Mr. Kinmond's calculation, a saving of Rs. 31-8 per diem. Mr. Kinmond contends that "tea dried with his machine, when the air is not changed every time it passes through the tea, must necessarily have a stronger and better aroma, for when his machine is used, the small quantity of air which it contains will very soon get loaded with the aroma of the tea and no more can be absorbed; but in his machine, although its aroma is an element which enters into its value; tea is dried by making the maximum quantity of air impinge upon it, and by so doing carry off a very large part of its aroma; every one connected with tea manufacture knows that the tea leaf gives off the greatest amount of aroma while it is being dried." Mr. Kinmond goes on to say that a new product from the tea plant will be produced by his machine as the moisture from the drying tea leaf, when condensed and drawn off by the tap at the lowest part of the fan, will be the essence of tea, and though the quantity will not be great, yet the accumulation of a season's work will be of very considerable bulk, and he thinks that if this essence of tea is collected in a concentrated form and properly preserved it will be of considerable commercial value. Just so. Mr. Kinmond's machine will produce *theine* in a diluted form, which is identical with *caffeine* and *theobromine* in its physiological action. Caffeine is the active principal of guarana which has been extolled as a remedy for migraine, or sick headache. So that Mr. Kinmond's machine will produce a delightful beverage, and at the same time, a possibly useful medicine. The price of this machine is £145, packed and free on board in London.

COFFEE.

LOVERS of the marvellous may find a fit subject for contemplation in the case of a single Liberian coffee tree, grown on the Massowa estate, which is said to have netted for its owners in one crop Rs. 6,000. This marvellous and unprecedented yield has come about in this way. A Badulla planter, about to put down a nursery of Liberian coffee, agreed to purchase the entire produce of one tree on the estate in question—the finest tree under cultivation—at the rate of fifty cents. for each bean, or one rupee for every berry. When the last gathering had been despatched to Badulla, there had been four thousand berries gathered, and there were still two thousand on the tree. Who will say Pagoda trees no longer exist? This case is of course strangely exceptional, and we only mention it as showing the result of a temporary short supply of this particular seed.

CAPTAIN NICKERSON, of the barque *Oluske*, lately arrived at New York from Padung, reports that he loaded his vessel there with a cargo of green Java coffee. Shortly after taking the coffee on board, the captain, his officers, and the crew commenced to suffer from headache and languor. This was attributed to Java fever, and quinine was administered accordingly. The vessel sailed from Padung on the 30th December. All the crew, captain and officers were attacked with violent headaches, alternate fits of vomiting, and purging, with a thick, black coating over the mouth, lips, throat, and tongue, and cramps in the legs. The symptoms were the same in all the cases. Quinine and other medicines were used, and gave some relief at first, which quietly wore off. The second mate died on the 10th of January. At this time the whole crew were nearly prostrated, and the chief mate nearly dead. The captain was also very bad, but he felt so much better when he was on deck and clear of the steam arising from the hold, that he had a place rigged on deck for himself and the mate. The crew also lived entirely on deck, and all hands soon got well. This is one of the most extraordinary cases of poisoning by the fumes of green coffee ever recorded, and it opens up a wide field of inquiry for medical men. The vessel reached New York in safety, and the crew had no more sickness after they had once lived entirely on the deck of the vessel.

COFFEE-ENTERPRISE IN 1877.

(IN SOUTHERN INDIA.)

THE year 1877 did not prove a very favourable one for the coffee-enterprise in India as well as elsewhere. Bad seasons prevailed everywhere, and the outturn of crops in consequence was considerably smaller than in the few previous years. In South India particularly, two successive seasons of drought told severely on the produce, and many a stout-hearted planter must have been dismayed at the dismal prospects. There were those whose opinion was worth something, who predicted that the bad seasons experienced, would ruin many a planter, and operate as a serious check on the coffee-enterprise in Southern India. And yet, but few estates changed hands, and we do not remember reading or hearing of any planter having been ruined. That great losses were sustained cannot be denied, but the indomitable pluck and perseverance of the planter have carried him through, and the prospects before him are now brighter. In the early part of the year, Ceylon exported 47,000 tons, against 36,000 during the season 1875-76, but the new crop did not turn out so well. Java exported 54,000 tons in excess of the previous season, while from Costa Rica, Guatemala, and Central America there was an excess of 5,000 tons. On the other hand, the Rio crop finishing 30th June 1877, gave only a total export of 159,300 tons, of which 63,000 tons went to Europe, against 61,700 tons the previous season. After that date the crop accounts from Costa Rica and Central America were unfavourable. The exports from Southern India only reached 8,000 tons, against 9,000 tons in 1876. The short supply of 1876 caused an advance in the price of middling Ceylon to 118s. early in January 1877, which disturbed the market for the following three months. With heavy imports and bad deliveries prices gradually receded until 99s. to 98s. was touched at the end of April. From that time prices recovered almost uninterruptedly until 110s. was again reached in September, to decline again to 105s. to October and November, the market closing quietly for all descriptions, except fine colony new crop Ceylon, which realized comparatively high rates. The fluctuations in good ordinary Native Ceylon were much smaller, the market opening at 89s. and closing at 86s. after touching 81s. in April. It must be very gratifying to South India planters to learn that Neilgherry, Coorg and Mysore coffee realized extreme prices in the first part of the, year, though there was a decline later on. Should peace be ensured in Europe, the imports of coffee this year into that Continent may be expected to be large, and the abundant rain that has fallen here will, no doubt, increase the outturn of crop. On the whole, coffee-planters in South India have no cause for despair. One of their principal difficulties will soon be settled by the enactment of a Coffee-Stealing Bill, and a Labour Bill will probably be soon introduced into the Legislative chamber of Fort St. George.

During the past year, coffee leaf-disease spread alarmingly both in South India and Ceylon. A few weeks ago we published an Order of the Government of India notifying an offer from an eminent French botanist to enquire into the causes, &c., of leaf-disease in South India, and enquiring whether the planters were prepared to pay his expenses during the investigation. A proposal has since been made to petition the Government to appoint a commission to enquire into leaf-disease. This is not a bad idea, and it would be a capital thing to have the botanist in question nominated on the commission. The greatest necessity exists for despatch in this matter, and we trust the planters will give it their early and close attention.

The Coorg Season Report for the second semester of 1877 is we regret to say, unfavourable. It is the same story every season,—hopes revived are dashed to the ground. Experiments with Liberian, coffee in Coorg have failed, but in Bangalore they have turned out eminently successful. Mr. Cameron, of the Lal Bagh, has taken some pains in the experiments, and his labours promise to be rewarded with success. Some of his Liberian coffee trees, two years old, are in blossom, and look extremely healthy. There can be no doubt that the climate and soil of Bangalore are admirably suited to the cultivation of Liberian coffee, and, before long, coffee estates in great numbers will, no doubt, spring up around Bangalore, which will become the centre of a large and important coffee district. It is a pity that the Government of the Province does not foster the enterprise by importing Liberian coffee seed and plants in larger quantities than it does, and distribute them to private individuals, instead of confining experiments to the Government Gardens.—*Madras Times.*

LIBERIAN COFFEE.

"AN old Planter" writes to the *Ceylon Observer* :—I have just received your book on "Liberian coffee" and will study it carefully ; I will also watch with interest the development of the experiments now being made to cultivate it in the low-country of Ceylon. I have no doubt whatever, that where the Arabian description grows, even to a low elevation, with sufficient moisture, the Liberian will thrive and produce well ; but it should not be hastily assumed that because it is now growing well in the low-country, under the exceptional weather of the past twelve months it can in the long run be successfully cultivated on lands subject to prolonged drought, unless in a remarkably deep, moist and rich soil.

The Liberian plant, as the Arabian, will be a deep or surface-feeder according to circumstances. It is generally thought by modern-coffee planters, that the Arabian coffee will not grow and produce, well, near and on the level of the sea, but those who have studied the history of the plant will recall the fact that the birth-place of its cultivation by Europeans was on the coast, actually below the level of the sea, in what afterwards became British Guiana. The Dutch commenced the cultivation in 1718. In 1752 one bag was exported from Demerara, and the cultivation culminated in 1823 by the export of 71,500 cwts. After the emancipation of slaves, it began to collapse, for in 1840 it was only 30,000 cwts. and has since almost ceased to be an article of export. British Guiana is as you know exactly opposite Liberia on the South American coast.

You know, that the late Sir William Reid, Bart., was led to come to Ceylon, from having had great experience in coffee planting in Demerara ; it was from him I learned, that the coffee was grown on the flat alluvial soil of the Essequibo river, along-side of the sugarcane and *below* the level of the sea, which had been dyked out by the Dutch. The alluvial soil was 90 feet deep, and there the coffee plant was not as in Ceylon a surface feeder ; its roots drew its nourishment from the moister and richer lower stratum, and it was therefore able to withstand exhausting heat and prolonged drought.

The moral of this story appears to be, that, to produce good crops of coffee, either through the medium of the Liberian or Arabian plants in an exhausting climate, there must be both sufficient moisture either from above or below, and rich nourishment.

P. S.—Professor P. L. Simmonds in his last edition (1877) of his "Tropical Agriculture," claims to have drawn particular attention to the excellence and prolificness of Liberian coffee 25 years ago !

CINCHONA.

ALL the cinchona plantations under the Forest Department are carried on in the hills near Toungboo, at Thantounggyee in the Sittang division. A school for young Karen lads, who had been engaged in learning the method of cultivation, had been opened, but it appears that its cultivation had not progressed very satisfactorily. We trust, however, that the school will continue with better results.

THE Acting Commissioner of the Neilgheries has officially reported on the Government cinchona plantations for the year 1876-77, and it appears that owing to the successful sales of bark in the London market, the financial results of the year were a net profit of Rs. 50,827. The increased demand on the part of the planters of the Neilgheries and in the Wynaad for Cinchona plants and seeds, is regarded as a satisfactory feature in the report. The account sale for 165 bales of cinchona bark lately shipped from those plantations to England shows that the Dodabetta natural crown fetched 6*s.* 3*d.* and 6*s.* 4*d.* per lb.; the mossed crown from 6*s.* 2*d.* to 8*s.* 5*d.*, renewed crown from 10*s.* to 10*s.* 4*d.* and the branched crown 10*s.* 0*d.* and 5*s.* per lb.

SAYS the *Ceylon Observer* in a late issue :—The question of Cinchona culture occupies considerable space in our columns on this occasion, but we have by no means exhausted what we have to say on this interesting and important subject. Cultivators must not be discouraged by the disastrous effects of the last wet and windy North-East monsoon—an exceptionally bad season. Neither do we believe that there is any cause, as regards *C. officinalis* for the "hybridizing," scare. On Dodabetta, if anywhere out of the Andes, the trees are pure ; and yet on Dodabetta we saw all the diversities of size, shape and colour of foliage which people so recklessly attribute to "hybridizing" in Ceylon. *C. officinalis* like *C. calisaya*, is highly "sportive," the same seed, or the same stock plant, for that matter, producing a dozen different varieties, with leaves varying from the size and shape of peach leaves to others which from their size suggest a cross with *C. succirubra.* Why it should, we do not know, but the thinner the leaves the better the bark, and then it is said, "Those are the pure typical trees ; the big-leaved ones are hybrids." We have yet to be satisfied that a spontaneous cross between *C. succirubra* and *C. officinalis* is possible. Mr. McIvor procured one by the usual artificial means, and the result was a bark of immense richness. Mr. Howard named this hybrid *C. pubescens*, and we trust it may be found possible to perpetuate it. Apart from the superiority which additional age gives to the seed of Nilgiri trees, we believe Ceylon seed will give just as pure results. We have observed largely with our eyes open, and we can, as yet, come to no other conclusion.

CINCHONA IN JAVA.

FROM a report on the Government Cinchona-Enterprise in Java, for the first quarter of 1878, we take the following :—

"The state of the weather has been very favourable for the plantations during the past months. Continuous heavy rain, varied but rarely by heavy showers, greatly furthered the growth of the young plants. The gardens suffered little from storms, which are not unusual at this time of the year, and scarcely a couple of days of strong wind were registered, by which also not more than a hundred trees, were destroyed, 2,333 days' work was performed by free labour. The work consisted in the planting of newly-formed gardens, and the upkeep of the existing plantations. The trials of mossing the trees were also continued. During the quarter 89,660 *ledgeriana*, 2,200 *officinalis*, and 9,520 *succirubra*, have been planted out. Specimens of the insects which caused the cinchona rust were sent to the well known Dutch entomologist Dr. Snellen van Vollenhoven. This gentleman reports thereon that they are perfectly identical with those which must be considered as the cause of the tea rust. The name is not *Heliopeltis theivera* as was stated, on the authority of British Indian agricultural periodicals in the report for the 2nd quarter of 1877, but *Heliopeltis Antonii, Sign.* These insects began to appear again in March in greater numbers. As many as possible were caught and destroyed. The chemical analyses have been continued uninterruptedly. They have now enabled the renewal of the bark on partly stripped and moss-covered trees and the quality of the alkaloids deposited therein to be followed, and the amount of quinine yielded by *ledgeriana* trees kept for seed to be ascertained. The results will be communicated in a future report."

CINCHONA PLANTATIONS—MADRAS.

THE *Madras Mail*, in two able articles, has been discussing the Government policy regarding these plantations, and the arguments advanced by our esteemed contemporary, deserve every consideration. The time has come when the Government should frankly say, what it intends to do with these plantations, and state plainly what objects are to be gained by retaining the management in their own hands.

The *M. Mail* points out that "so long as able officers like Broughton and McIvor were engaged in experimental works, it was obvious that every years's experience added something to the stock of knowledge, by which private enterprise might benefit, equally with the Government experiment ; but for the last four years, since the disappearance of Broughton, and the death of McIvor, nothing has been done by Government officials that could not be as well, or better, done by private individuals. The one great work yet unaccomplished, is the experimentation in artificially hybridising the most promising species of plants; and unless the Government are prepared to pay at the least £600 a year for the services of a properly qualified person for the next fifteen or twenty years, to conduct a carefully selected series of experiments in this direction, and to keep a public record of his work, we do not see that they can do any good by keeping the estates in their own hands. The sole justification of this proceeding is, that the Government can do work which private individuals cannot afford to take up. But private individuals can grow cinchona as well as the Government. They can harvest their barks so as to command even higher prices than the Government produce; but they cannot wait in patience to watch the effects of scientifically devised experiments, in the crossing of new and promising species, and to investigate intricate questions connected with the development of alkaloid in the living plants. If this work is to be continued, Government alone can do it, and with this object must maintain a certain area of cultivation for purely experimental purposes. If a fair value can be obtained for the present estates, there would be a sufficient profit on the experimental cultivation to pay for the services of a scientific man for many years to come Government has always maintained that this cinchona farming experiment, was never undertaken with a view to profit, and consequently any money received for the estates, over and above outlay and interest, might well be spent in working out all those questions, which are practically useful in encouraging private individuals to take up the culture of bark. In this way only does it appear to us, that the Government can properly maintain their connection with cinchona cultivation."

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA

Monthly General Meeting held on Wednesday, the 22nd May 1878.

The Hon'ble LOUIS S. JACKSON, C.I.E., *President, in the Chair.*

THE proceedings of the last meeting were read and confirmed.

CONTRIBUTIONS.

1. Fragmenta Phytographiæ Australiæ, Vol. X. By the Baron Ferd. von Mueller. From the author.
2. Report of Commissioners for 1876 of the Department of Agriculture, Washington. From the Commissioners.
3. Catalogue of specimens of Timber for the Paris Exhibition of 1878. From the Government of India.
4. Progress Reports of Forest Administration for 1876-77 in British Burmah, in the Punjab, and N.-W. P. From the Government of India.
5. The Indian Forester, No. 3, Vol. 3. From the Editor.
6. Journal of the Bombay Branch Royal Asiatic Society for 1877, No. 35, Vol. 13. From the Society.
7. Journal, Asiatic Society of Bengal, Part 2, No. 4, for 1877, and Proceedings, December 1877 to March 1878. From the Society.
8. Report of the Committee of the Bengal Chamber of Commerce, May to October 1877. From the Chamber.
9. Seed of a gigantic fodder grass, Festuca dives, which thrives in humid valleys of forests. From the Baron Ferd. von Mueller.
10. A small quantity of Guinea grass seed. From W. B. Carshore, Esq.
11. An assortment (32 kinds) of Bangalore acclimatised flower seeds. From the Superintendent of the Royal Botanic Garden, Bangalore.
12. Four seeds of *Amherstia nobilis*, from Moulmein. From Major R. W. H. Fanshawe.
13. Roots of Primrose from Mozufferpore, Tirhoot. From T. M. Francis, Esq.

The Gardener reports that the *Amherstia* seeds rotted as soon as put out into moist earth, and that the primrose roots died shortly after arrival.

GARDEN.

The Gardener's monthly report was submitted. "A pipe drain has been laid down from the entrance tank to the nursery to economise labour in future in watering. The new roses have been planted in the beds prepared for them and the duplicates potted into larger pots. I have also planted out such other of the new plants to grow on for stock in position calculated to suit them and stock will be quicker produced thereby than in pots. I have likewise planted out two beds of Palms of common kinds: there are three other beds left, but as the stock of better class of Palms is very limited, I thought it better to leave them for the rainy season when there will be a better chance of their succeeding with less injury, &c. A great quantity of Crotons I have planted out into beds, freeing a quantity of pots; these can be reported at end of rains and disposed of; thus they will by that time be good size plants. A quantity have, also been put into larger pot, and are now nice plants in all sizes from 6 inches to 2 feet high, bushy, &c. The general distribution stock is now vastly superior to what it has previously been, and less of the very common stuff, and I have nearly prepared every thing necessary to render the giving over charge to a successor easily."

BAMIA COTTON.

Reports, with specimens, from the Cawnpore Experimental Farm, Mr. W. Masters of Hajeepore, and the Secretary, on the result of trial with the Bamia cotton, from seed presented in June last year by Mr. J. C. Chapman, of Alexandria, were next submitted, together with a favorable report by Messrs. W. H. Haworth and Co., on the specimens. The Secretary stated he had incorporated all this information in the form of a paper which was transferred for publication in, the Journal. The Secretary also intimated he had requested a further supply of seed from Mr. Chapman to supplement the small quantity of acclimatised seed in stock, though judging from some remarks in a recent letter of the *Times'* Alexandria correspondent, it seemed doubtful if such seed could now be relied on. "The way in which the seed is mixed," observes the writer, "is admirably illustrated by the recent experiments made in the Bamia cotton plant, which was to revolutionize the cotton market by its productiveness and quality. The seed ran up to 10, 20 and even 30 times the price per ardeb of the ordinary seed. This was too much for the sellers. In every case there was adulteration, and no experiment has proved decisive on account of the admixture of other qualities."

REANA LUXURIANS.

The Secretary reported the receipt, in continuation of those announced at previous meetings of applications for seed of *Reana luxurians* from the Government of the Punjab for the Superintending Engineers, Barri Doab and Western Jumna Canals; from the Agent, Governor-General, Baroda, for trial on his Highness the Gaekwar's territories; from the Superintendent, Horticultural Gardens at Lucknow from the Superintendent of the Lall Bagh; Bangalore, and others; about two hundred packets of seed acclimatised in the Society's garden, had already been distributed throughout the country, and applications, were still coming in daily. He also submitted a translation of a paper on the subject, which has appeared in a recent number of the Monthly Proceedings of the Acclimatisation Society of Paris as likely to be useful to those who are interested in the spread of this valuable fodder-grass which has now been so successfully introduced solely through the exertions of this Society. (Transferred for Journal.)

SILK.

The subject next submitted had reference to the proposed introduction of sericulture in the Canal banks in Orissa. Mr. D. B. Horn, Assistant Secretary, Government of Bengal, P. W. D, submits communications on the subject from the Superintending Engineer, Orissa Circle, and the Executive Engineer, Mahanadi Division, describing the result of some experiments made by Mr. Atkinson, Supervisor, on the rearing of silk-worms, and the silk obtainable from the cocoons. "The subject is one," observes the Chief Engineer, "on which I can offer no opinion; but as Government has now under consideration certain proposals for planting trees on the spare lands adjoining our canals and distributaries, perhaps you may deem it worth while to have the opinion of some experts on the quality of the enclosed silk, so that a proportion of land available may be reserved, if considered advisable, for the cultivation of mulberry." Messrs. J. Thomas and Co. had kindly reported on the cocoons and raw silk, and the report is altogether favorable so far as the small quantity would enable them to judge. The Secretary added, he had replied to the best of his ability, to the queries in Mr. Horn's letter.

REMARKS ON THE TREATMENT OF SILK-WORMS.

In connection with the above, and to the communication from Mr. DeCristoforis, in the Proceedings of the last meeting, the Secretary submitted the following remarks from Mr. C. E. Blechynden, in reference to the present mode of rearing silk-worms:—

"I see in the Society's report in to-day's *Englishman*, a communication from Mr. DeCristoforis regarding the introduction of silk worm eggs from Japan, and animadverting on the degenerated stock of the worms, now reared in Bengal.

"Is it to be assumed that the mere introduction of a superior and healthier breed of worms would do away with degeneracy of the worms of the country, because the cause of degeneracy is not touched on. Is it merely to be ascribed to a wearing away of vital powers. Then, it is to be asked, what has caused the depression, and would not the imported worms in course of time be equally affected? Perhaps Mr. DeCristoforis means that eggs should be imported each year, but who are the parties that would take advantage of Mr. DeC.'s offer to carry out such a plan? I am not aware of any Europeans being engaged in sericulture in Bengal, natives alone follow the occupation. Would it not then be better at first to look at their mode of rearing, and see if no reform could be introduced that would raise the vital powers of the worms now existing, than to follow the plan of getting fresh eggs each year from Japan. Natives are highly conservative, and have a keen regard as to the outgoings of their money; once in the way a native may be induced to buy a card of eggs, but it will be a long time before he incurs a second outlay for the same purpose, at least not till the imported worms have degenerated down to those of the country; so that the proposed plan for fresh eggs has only a temporary effect, as the cause of degeneracy remains untouched: it is here that efforts at improvement should be made.

"Look at sugar-cane, cotton, tobacco, Carolina paddy; how has good seed and bad culture ended in failure; so it will be with the silk-worm. It is the plan followed in rearing that does all the mischief: the breeds of worms of the country being acclimatised are quite capable, by proper breeding, of giving returns fully equal to Japan or Italy.

"I beg to refer you to my remarks published in the Society's Journal in 1858, as regards Mr. Bashford's experiments in cross-breeding with Europe silk-worms.

"I would undertake in one year to produce for cocoons the Bengal worm that would stand comparison with cocoons reared in Japan."

In a subsequent communication the subject is continued, as follows:—

"About silk-worms. I agree with you that the infusion of fresh blood (so to call it) into the present decrepit breed of insects reared in this country would be a gain, but only so far as it would save time by reviving the failing powers of the Bengal insect, provided a new leaf were turned over as to the mode of rearing. But what I argue is, that all efforts to improve the culture of a better description of insects, vegetables, or plants, by fresh importation, would be and would have been in vain, unless the foundations are, and had been materially altered, or in other words a more rational and better suited plan adopted. In the case of vegetables, can we say that the simple fact of fresh importation of seeds has alone been the cause of improvement, or has a better mode of culture?

"I write with a full knowledge of my subject, having for years studied all the *minutiæ* of rearing, as followed by natives. In my own experiments, I have, by totally discarding all their palpable errors, succeeded in producing (*without imported insects*) a breed of worms that gave results in silk of a superior quality, the yield being twice as great as that given by the same breed of worms in the hands of native rearers."

COMMUNICATIONS ON VARIOUS SUBJECTS.

The following papers were also submitted:—

From J. E. O'Connor, Esq., presenting notes on a new fibrous-yielding plant (*Malachra capitata*).

From Col. W. H. Lowther, forwarding certain papers for "Gardener's note-book"—(1) on Indian Culinary vegetables, (2) on Indian Vegetables; (3) on the culture of Leeks; (4) on cheap hand glasses and their improvements; (5) notes on Flower-gardening.

From Capt. J. F. Pogson, suggestions for guarding against the consequences of droughts in the future.

From F. R. Tottenham, Esq., on extensive planting of trees throughout the country to aid in reducing famines in future.

The above were transferred for publication in the Journal.

From O. Wood, Esq., Deputy Commissioner, Rohtuk, applying for information regarding the cultivation of the earth-nut (*Arachis hypogea*). Complied with.

From J. P. Stratton, Esq., seeking information respecting the "Mesquit Bean." Complied with.

From Messrs. Duncan Brothers, requesting particulars (with reference to Capt. Pogson's communication on the subject in the last published Proceedings of the Society) on the cultivation of the water-nut (*Trapa bispinosa*) on behalf of a correspondent in Cachar who has means of carrying it out on a large scale. Complied with.

From Messrs. Geo. Henderson and Co. applying, on behalf of Mr. M. David, of Dacca, for the loan of a Cotton Saw Gin. The Secretary reported that he had transferred the Gin from Messrs. Bates, Hyde and Co., of Massachusets, which competed successfully many years ago for the prize offered by the Government of India through the Society, on the understanding that Mr. David favours the Society, in due course, with the results of his trial.

For the above contributions and communications, the best thanks of the Society were accorded.

ADVERTISEMENTS.

NOTICE.

MR. F. A. COHEN is appointed Manager of the *Statesman and Friend of India* Office, and has assumed charge this day.

All communications concerning the general business of the Office, Advertisements, and Subscriptions to the daily *Statesman and Friend of India*, weekly *Friend of India and Statesman*, and *Indian Agriculturist*, should be addressed to Mr. Cohen.

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R. KNIGHT,
Managing Proprietor,

Calcutta, 18th April 1878.

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NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb. 1876.

R. KNIGHT.

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Calcutta, 18*th April* 1878.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

TREES AND RAINFALL.

TO THE EDITOR.

SIR,—In the Gujrat sub-division of the same district of the Punjab, the lands are crossed by roads planted with avenues of trees, so that the place is green and agreeable in its aspect. The system of tree planting extends to an area of 25 or 30 square miles, and as the trees have been planted more than 25 years, a good chance is afforded for testing the effect of trees on the rainfall, the productive powers of land, and the general health and prosperity. This question has been agitated recently, and Surgeon-Major Balfour has issued a series of questions to the Forest officers through the Secretary of State, and the local newspapers. Controversies have also appeared occasionally on the subject. A 'European Zemindar,' gives testimony to the injurious effect of trees on the productive capabilities of land; but his judgment appears to be formed without correct scientific data, or from limited sources. Hence, I hope, my communication will not be considered out of place. The trees planted in the avenues referred to average about six to seven hundred per square mile. This does not include trees in the fields, mostly *keekar*, the property of the landholders, who have been denuding the land of them freely in recent times to supply the demand on railway works and for fuel. Hence, here also the investigation as to their goodly offices within the last decade must lose some of its force.

From carefully collected information, gleaned from the putwaris' papers, from the cultivators themselves, and extending over a period of 30 years, I am able to show that the annual average rainfall has increased more than 3 inches, and that the outturn of the land is nearly 10 per cent. in a given area, more than it was 15 years ago. The increase cannot be attributed to any superior mode of farming, or manuring, for the former has not advanced, and the latter is never practised in land devoted to grain crops. It is to be observed, however, that the land is not now allowed to lie fallow, as in the Sikh times, but is, on the contrary, overworked, while it benefits little from the slight surface dressing of leaves blown to it by the winds. The trees, unfortunately are not allowed to perform their office to the full extent, for in winter as soon as the trees shed, the surrounding villagers sweep up all the leaves they can for their ovens. One must call to mind the recent warning of Professor Hooker, regarding the English parks, that so soon as the present trees die off, a new growth cannot be expected for at least half a century, owing to the fallen leaves and seed being sedulously removed. It is not too late perhaps to stop this Vandalism in the Gujrat tract. It should be stayed, for trees bring the riches of the lowest undersoils and cast them on the surface. In this tract the general health of the people is unusually good, and the trees seem to have had a marked influence in lowering the temperature and electric phenomena. It is true that the shadow of trees keeps the crops from thriving that are close by, but their advantages greatly over-balance this drawback, and all roads it would seem should be planted.

Gujrat, 14th July 1878.

W. J. B.

FLAX MANUFACTURE.

SIR,—I notice in an issue of the *Statesman* of the 20th instant, a paragraph from the *Behar Herald* on "Flax Manufacture." As a practical Irish farmer for the last twelve years, I must respectfully refute a number of the assertions made therein, as being mere conjecture. In the first place, I always understood that the flax-grower sold his flax to the spinner, and that it was the spinner's duty to prepare it for the weaver; but your contemporary seems to think that to grow flax successfully, the grower should have the knowledge of the spinner combined with that of the farmer. Is he aware that the native linseed is almost useless for producing fibre, especially as it is grown by the *ryots*, or does he imagine that even if the native stalk would produce a profitable fibre, the ryot would part with it for four annas a maund, when he knows the buyer could sell the manufactured flax for Rs. 36-8 per maund? Where, may I ask, has he learned that there are no such things as rippling combs in the country. I have seen them used by several planters.

But the most ludicrous statement is the price of flax in the home market. If the writer in the *Behar Herald* wishes to see samples of last year's Irish flax, I shall be happy to show him some, and I can also tell him that the highest price reached for flax last year was £75 per ton. This year it was a very rare sample that sold at that price, the average price being about £60 per ton. I can produce the market quotations to show that this is the case. The prices of Russian, German, and other flax did not reach £40 per ton. How therefore can the *Behar Herald* support the erroneous assertion that flax in the home market was selling at about £100 per ton? I could gratify his curiosity by showing him a sample of flax grown, retted, and scutched in this country that will bring the round sum of £45 per ton in the home market, but I daresay he would laugh at such a price. His idea would be to buy up all the old linseed stalks from the ryots at four annas a maund, and convert it into a fibre that will make linen of the most delicate and valuable description. I shall be glad to see the coming hints on flax-growing that are to appear in the *Behar Herald*.

X. Y.

BAMBOO CULTIVATION.

SIR,—I have just received your journal of May 1st and note therein in "Forest Reports," "Bengal Section," that an "experimental "bamboo plantation extending over one acre has been established' inferentially in the Sunderbuns where it is stated "Root off-sets planted "in April, May, and June, had practically speaking failed," and "that "there can be no doubt that bamboos will not grow on land flooded by "high tides."

Unfortunately I am a paper-maker, living in the North of England and never having visited India nor the Tropics am entirely dependant on the information I can derive from books, or kind and sympathising, friends as to vegetative growth in such localities, and regret to have to say that the information thus attained, so far as relates to bamboo, is extremely conflicting and contradictory.

For example, it is reported to me (and through a reliable channel) that the most prolific growth of bamboo is found near water-courses on the banks of the rivers in Burma, the Attaran, Pegu and other rivers I am led therefore to infer that the high tides referred to in the Sunderbuns are too salt, or that the water is too long on the land, the want of drainage rotting the roots.

I would ask through your columns whether the bamboo *now* grows in the Sunderbuns, and if so, where, and how? That is if it does grow and flourish as I have been informed it does, is it where it is subjected to this flooding by high tides?

I would also ask from some of your readers who may be kind enough to give an opinion on the matter whether the bamboo will not propagate more certainly and more readily from stem cuttings than from rhyzomes or root off-sets, as I am advised from the *West Indies* the practice is invariably to propagate from the former; also whether the months of April, May and June are the *most suitable* for planting, being in the d[illegible] season.

That there will be doubts and difficulties as to the proper system of propagating a plant like bamboo, which although well known to every one residing in, or who has visited the Tropics, has hitherto never been systematically cultivated, can readily be understood; my desire is, if not to remove, (as unfortunately from lack of sufficient information this is not in my power) to facilitate the elucidation of the question in all its phases, not merely as to propagation, but to ascertain whether the bamboo can be cropped continuously, or season after season, without prejudicing its stem producing powers, perennially or otherwise.

I do not attach much importance to the assumed failure in the Sunderbuns, as if that locality will not answer for bamboo, there can be no question whatever that others [illegible]where it now flourishes) will.

It has also been stated that years must elapse before the bamboo raised from cuttings or root off-sets will be available for productive stem growth. I have been assured that in suitable localities two years will suffice to produce stems 20 to 2[illegible] feet long; therefore, if these my informants are correct, any difficulty in continuous cropping would be met by putting a larger acreage under plantation, as even then the bamboo would yield a raw material for paper-making cheaper than any now known.

That bamboo stems treated as I proposed will make paper of excellent quality we know; all now required is to ventilate and clear up some of the doubts raised as to the propagation and cultivation of th[illegible] acknowledged valuable paper-making material.

CLAXHEUGH, SUNDERLAND,
4th June 1878.

THOS. ROUTLEDGE.

POVERTY OF THE NATIVES OF INDIA.

SIR,—Turning over some old books the other day, I came across a little book entitled "A collection in prose and verse for the use of schools in the Bombay Presidency," published at the Baptist Mission Press, Circular-road, Calcutta, in 1840; and at page 31, I read the following under the heading of *Hindustan and England*:—

"Bengal is about the same size as Great Britain, and each contains about thirty millions of cultivated acres. The revenue collected in Bengal is less than £3,500,000, in Britain it is more than £50,000,000. In Bengal the value of the gross produce of the land is little more than £1 per acre, and the expense of cultivation, from the waste of labour and insufficiency of implements, averages three-fourths of the gross produce: in Britain it is £5 an acre, and the expense of cultivation little less than one-third of the gross produce. So that, though the gross produce of Britain exceeds that of Bengal only five-fold, its net produce exceeds that of the latter twelve-fold. But the agricultural produce of Bengal constitutes nearly the whole of its annual creation of property; in Britain it forms but one-half of the aggregate gross revenue. In Bengal four-fifths of the population are agriculturists, the greater portion of the remainder are artizans, whose earnings are a mere subsistence, that is, do no more than defray the expense of production; a very few are rich bankers and merchants, the rest are petty shop-keepers, servants, &c. In Britain only one-third of the population are agriculturists; more than that proportion are employed in manufactures, in which large capitals are invested; and the rest of the productive labourers are engaged, under the agency of extensive capitalists, in mines, shipping fisheries, banking, &c. In Bengal a gross produce, of £3[illegible]0,000, divided by 21 millions, gives £1-7*s.* for each individual; in Britain, a gross produce of £150,000,000, divided by four millions gives £37-10*s.* for each individual; and £430,000,000, divided by seventeen millions, gives £25-5*s.* for each individual. In the West Indies, the yearly value of the produce exported, exclusive of what is consumed by the inhabitants themselves, is £13 18*s.* 6*d.* per head for man, woman, and child, black and white."

The above was written nearly 40 years ago for children. The Government (or what passed for such) then endeavoured to keep British capital out of India. the Government, of the present day does the same. India requires to have her manufacturing industries developed, and there is no money in the country to do it with, yet the European non officials with their capital and energy, are kept out of India through the dread of their becoming a body sufficiently strong and powerful to control the mischievous proceedings of the present bureaucratic form of Government. And yet no publicist in India recognises India's need for Western capital and energy; at least none advocate it, except in a desultory manner, and at long intervals when they have nothing else to write about.

Has the Press Commissioner any information to supply about the establishment of manufactures, and the introduction of Western capital into India? Has he anything to say about the construction of a line of railway from Calcutta, *viâ* Midnapore, Sumbulpore and Raepore, to Nagpore? *Wheat is rotting in that direction for want of means of transport. Is it not?*

G. P. P.

OPIUM *vs.* WHEAT.

SIR,—To the causes of the ryots' wretched and stricken condition under British rule, pointed out in the *Statesman's* leader of the 4th instant, on the Nizam's settlement report, permit me to add another item—*viz.* the *Opium cultivation;* which, from what I have casually observed concerning the North-West and Oudh districts, threatens to take the place of staple cereals of the cold season. Up-country cultivators have begun to look upon the opium traffic, as a road to fortune; and when they find that opium lands give cent. per cent. profit, where wheat gives only some 20 per cent. or less, they scarcely want a better motive to give up the latter for an increasing growth of the former.

In Mr. Schrottky's *Rational Agriculture,* some interesting particulars, as to solution of famines, are given of the continuous deterioration of Indian soil, and the consequently diminishing yield of staple cereals from period to period, for the increasing population all over British India. Add to this deterioration, the entire abandonment of thousands of acres of wheat land for the poppy cultivation, and we get an insurance of the inevitable—that famines will become more frequent and widespread and prolonged in their occurrence. Surely there are spots in the territory, more than in the sun, which demand investigation by our administrative astronomers!

CIVIS.

July 6th, 1878.

Note.—There is room for both wheat and opium, under wise rule. It is idle to be denouncing opium cultivation, when it produces a clear nett profit of £6,000,000 a year to the people.—ED., *I. A.*

INDIAN GUANO.

SIR,—In Persia, for centuries, the fertilising value of pigeon's dung has been fully appreciated. The melon culture of that country has long been practised in conjunction with a system of dovecotes; not less than 1 to 2,000 kinds being kept by each field proprietor, about a handful of the dung being mixed with the soil around each plant. It is the most heating of any manure I know, and requires great caution in its application, for some remote parts of India, far away from towns. I have found old beds of this indigenous guano at the roosting haunts of the wild blue pigeon. Once in the Punjab I found some cart-loads beneath the spreading branches of an ancient banyan tree. In dry wells all over the N.-W. Provinces and among ruins of old cities and cemeteries, a good stock may often be found, but to the horticulturist on a large scale, I recommend the tame breed of birds as more manageable, and not given to distant flights and the consequent mischief to farm crops. A deep pit like a well with numerous nest holes in the side, and a hanging circular wall roofed in at top (to keep out the cats, and give shelter from bad weather,) will be the cheapest and most capacious form of dovecote.

W. H. L.

ASHES AS A FERTILISER.

SIR,—Ashes act as valuable fertilisers when the soil is rich in organic matter, and in good heart. But the cultivated lands of India require something more than ash manure; they want organic matter, phosphates, and nitrogenous manures. Near Edinburgh, where the town sewage is utilised as a manure for meadow lands, the average rent of the lands so treated is £40 per acre; and five heavy crops of grass are gathered annually, though the Scotch summer is a short one! On the 15th of February, I sowed jowar (*sorghum holcus*) for bullocks' food in five acres of land that had been previously manured with indigo refuse water. The crop grew luxuriantly without the aid of artificial irrigation, and was ready to cut on the 6th June: from which date I commenced to feed my cattle with it. The average height of the crop was 9 feet on the 6th June, and it is cutting out at the rate of 581 maunds of green food per acre. The rainfall since the crop was sown has been in—

February	*Nil.*
March	"
April	0·55
May	2·75
First 3 weeks in June	*Nil*
From June 24th to 30th	2·35
Total up to date .	5·65

From the above IGNORAMUS will be able to see that the crop reached maturity with a rainfall of only 3·3 inches during the hottest season of the year. Ashes applied as a manure would never have produced these results. The town sewage and the indigo refuse water are nitrogenous manures. IGNORAMUS will now be able to judge between them and ashes or any other mineral manure. For tobacco, the most exhausting of crops, the favourite manure, even with the natives, is vegetable matter. Old cow-dung is also the principal manure used for poppy. In fact, the most valuable crops are raised in India with vegetable and farm-yard manures.

D. W. B.

CASHMERE.

(FROM OUR OWN CORRESPONDENT.)

JUNE 1.

THE weather up to a few days ago, has been causing the greatest anxiety to every one. We have not had for months continuous seasonable weather since the 14th of last October. Rain has continued to fall at intervals of a few days throughout the spring, and with frequent cloudy days and land full of wet, there has been an unusual number of insects propagated.

We are wishing for a suitable season to harvest wheat, barley, and linseed, and for sowing the usual crops, especially maize, millets, cotton, and paddy. In the south-east district, sowing is almost completed, and it is there the crops are ripe. In the north-west sowing is late and harvest will not be ready for another three weeks. In the former district, the ripe crops are above an average, and the young crops full of promise: whilst in the latter district the reverse is the case, excepting that paddy is doing well.

The famine, which commenced here in the beginning of April, has been most severe in the north-west, and large numbers have left the country over the passes, not being allowed to leave by the roads. For the next eighteen months, grain will be scarce in Cashmere. This year bunds have given way, and large areas are under water that ought to be under cultivation; and although over one-half the working cattle died, there is more land prepared than has been supplied with seed. There appears no likelihood of more than half the quantity of grain being reaped in the autumn, in comparison with the yield of 1876.

The present scarcity is not owing so much to last season's rain destroying large quantities, as the loss of grain stored; no one thought of a famine, until they heard late in the spring of the paddy rotting in the store-houses! It is to be much regretted that such distress should have been caused for the want of good store-houses.

Mulberries are just coming in, and large numbers will be saved by them. Vegetables are not forward enough in all parts to be in general use: herbs and weeds are always eaten in abundance, and this season there has been little else in the famine district.

The Indian Agriculturist.

CALCUTTA, AUGUST 1, 1878.

THE BENGAL ZEMINDARS.

Apropos of Sir Ashley Eden's proposal to declare occupancy tenures transferable, we have been treated to more than one statement of the historical grievances of the Bengal zemindars. These grievances are a part of the stage furniture of a certain party, like Mr. Crummle's pony, in *Nicholas Nickleby*, and we would recommend that they should be treated as the great manager acted with that useful animal, of which he declared that he had "never come to the pony until everything else has failed." The nag is not to be trotted out every evening. It is of little use to repeat over and over again that the zemindars are ill-used men, found by the English Government in full possession of the land of the country, and ousted from their rights in 1859, in favour of their own tenants. The assertion is too glaringly contradicted by the facts to be credited, however often it may be iterated. Even the maze of quotations from old Regulations, and modern Jurists, with which a difficult subject has been still further perplexed, must fail to deceive the most casual reader, though they may certainly puzzle and repel him.

We know of no class of persons who have been so lucky in money matters as the Bengal zemindars. The rate at which the value of their interest in the land of these provinces has increased is really marvellous. We do not refer to the security which they have gained as to the title. When the East India Company assumed the Government of Bengal, the zemindar held a very equivocal position. In form their tenure was that of an office, granted by a *sunnud* for life, and subject by the terms of the *sunnud* to very onerous burdens. These offices were hereditary by custom, and alienable by sufferance, but on such occasions the consent of the ruling power had to be solicited by a formal petition and by gifts. It is not our intention to dwell on the advantage gained by the conversion of a doubtful right of this sort into a tangible property. We wish to speak only of what is still more striking, the enormous gain in money by which the transformation has been attended. On this subject we are not without accurate information. We know that the old custom of the Company was to divide the rent collected from the cultivators into eleven parts, of which the State took ten, leaving the zemindars one only. The Perpetual Settlement was based upon this principle. We find that the land revenue fixed by that Regulation was two millions eight hundred thousand pounds, and it follows that the zemindars' share was two hundred and eighty thousand pounds, a little more than a quarter of a million sterling. This we consider but scant remuneration for the risk of collection, to say nothing of the other duties which the zemindars had to perform. We are not, therefore, surprised to find that they were miserably poor, a fact on which all Bengal observers at the beginning of this century were agreed. Neither is it wonderful that, in spite of the frugal lives they led, they were unable to pay the revenue with the punctuality expected, and that most of them were sold up for arrears. The new purchasers obtained their estates for nominal prices; they were generally the ministerial officers of the courts, or the revenue staff. They came in as the tide turned, and their good fortune might be a proverb. Estates bought for an old song are now worth lakhs of rupees. The revenue on the land assessed at the Perpetual Settlement has slightly increased, owing to the addition of new estates. We have said that it was two millions eight hundred thousand pounds sterling; it is now, for the same districts, three millions and-a-half. The zemindars profit, as shown by the road cess returns, is twice this, or seven millions sterling. This is twenty-eight times the amount realised by them at the time of the settlement. It is to be remembered that this enormous increase of income has come, in almost every case, altogether without exertion. The landlord often lived far away from his estate, he made no attempt to aid the ryots in clearing jungle, still less in any more elaborate improvement. He simply bid a few rupees for a village at an auction, paid its revenue out of the rent, and sat by, until by the general advance of the country, its value multiplied twenty-eight fold. We may look round the world without finding another instance of a class thus enriched by chance. The American who strikes oil is an exception; the owners of land near London, like the Dukes of Westminster and Portland, are few: but here we have a whole section of the community raised in two or three generations from comparative poverty to wealth. We are aware that in many cases the land has been so subdivided, and the fractional interest of each sharer in it is so small, that it is most common to find a zemindar who is very poor. On the other hand, those whose dealings have been on a great scale are enormously rich, and taken as a whole, considered as a class they have been most lucky. It is always Fortune's spoilt children who grumble. The Bengal zemindars might have been thrust aside, like those of Madras and Bombay, with some slight pensions, secured on the land, as compensation for the loss of hereditary offices. At one time, under the administration of Warren Hastings, it seemed likely that such would be their fate. It is their good luck that they have been left in their original positions with their old profits increased twenty-eight fold. Perhaps it is not in human nature to bear such prosperity meekly. It is natural that those who have got so much should ask—why leave any one else anything? Our claims having been met more than in full, why not altogether ignore those of inferior tenure holders? Our income has increased twenty-eight-fold; why not fifty-fold?

The particular grievance of the zemindars is, that in 1859, by the law known as Act X of that year, the Legislature of India encroached upon their property, for the benefit of a certain class of ryots, by acknowledging in these a right of occupancy, whereas they were in fact merely tenants-at-will. The privilege thus assigned to the cultivator is found inconvenient to the landlord, because it prevents the raising of rent otherwise than under the rules laid down in the Act. Now, before 1859 the zemindars had no power to alter the customary rent in any way. By the Regulations of 1793 all ryots, without exception, whether they had special privileges or not, were declared entitled to hold at the customary rates of the district, as registered in the office of the Collector. In case of dispute it was provided that the Judge should ascertain, record, and enforce these rates. There is no provision before 1859 for any means of raising those standard rents. They were immutable, and while the zemindar could introduce them wherever he found it to his advantage, he could not go beyond them in any way. He was left to seek for an improvement of his income, as Lord Cornwallis very distinctly said, only by bringing a greater quantity of land into cultivation; and when we remember that estates were large in proportion to the income reserved to the zemindar, we can see that this alone was a great boon. This was the state of things when, in 1857, Mr. Currie set about dealing with the whole question of landlord and tenant. He acknowledged it, and in the Bill, which afterwards became law, these fixed rates were left unchangeable, and made to apply, as of old, to every resident ryot, without distinction. If passed in that shape the law would have been an inestimable boon to the country. But while it was still before the Council, the Mutiny burst upon India, and for a time delayed all domestic legislation. After that catastrophe, Lord Canning approached the question in a different spirit. He had taken up the old feudal idea of holding the country through landlords. He had recently given effect to his views by declaring cancelled the settlement concluded before the mutiny with the ryots of Oudh, and confiscating their land to give it to the rebel Taluqdars. Entering upon the discussion in this spirit, the Council made two important amendments in the law as originally drafted. In the first place, they restricted its protection to tenants who had been twelve years in occupation of the same land, without the usual change of fields, and then they decided that, even as applied to these, the customary rates might be raised in proportion to the increase in the value of the production of the farm.

The Act having thus been changed so as to be unduly favourable to the zemindars, the latter of course cried out against it. What it gave to them they took as a right, and they clamoured for what was still left to the ryots. The right of occupancy was, at the last moment, restricted to those who had been twelve years in occupation, instead of being left, as before, common to all: this was most ingenuously represented as the gift of a new privilege to this class. Zemindars were, for the first time, allowed to enhance their rent in a particular way, in addition to their old right to raise it to the customary standard: this was declared to be a restriction on general and unlimited enhancement. It was said that the Legislature had encroached on the interests of the zemindars, for the benefit of the ryots. This is unfortunately a charge which carries with it its own refutation. It is not the rights of the rich and influential, on which legislatures are wont to encroach, and if they commit injustice, it is not for the benefit of the poor and silent. Who would care to take privileges from a class which includes all the powerful natives of Bengal, and most of the Europeans having a permanent connexion with the country, to give them to men unrepresented, dumb, without union or weight, like ryots? Certainly not men fresh from the confiscation of settlement rights in Oudh, wise with the cynical wisdom of the mutiny. It was their policy to give largely to the zemindars, from that over which they had no just control,—the ryots' share of the crops. They did so, and were rewarded by ingratitude, as they richly deserved to be. The part which the zemindars play best in political discussion is that of Oliver asking for more. Sir Ashley Eden wishes to teach them another, to get them voluntarily to consent, through their representative Association, to give up something, by allowing the ryots to be declared in all cases capable of selling their rights, as they can do now in many districts. The concession asked for is not large, and the Lieutenant-Governor has over their leaders an influence never gained by any of his predecessors. But they meet his demand by trotting out the old pony again. Far from being prepared to yield to others, they want a great deal for themselves. And the question to them is, not whether they will concede anything to Sir Ashley Eden, but how much they can extort from him in the shape of new and more crushing machinery for the enhancement and realisation of rent.

SIR G. CAMPBELL'S "MODEL" FARMS.

THE paper read by Mr. Danvers (India Office) in May before the Society of Arts, on the subject of Indian agriculture, which will be found elsewhere in our present issue. We refer to the essay here, for the purpose of noticing some curiously inaccurate remarks made by Mr. Cotton, in the course of the discussion that followed, on the subject of the model farms, started by Sir George Campbell in this Presidency in 1872-73. Mr. Cotton is reported to have said:—

> He could only say that all the model farms in Bengal had failed in a financial point of view. They were started with every prospect of success, Sir George Campbell himself being enthusiastic in their favour, and he got the best men he could to manage them. But they not only failed financially, but in an agricultural point of view; for the outturn of the crops had not been equal, in a single farm, to that which was obtained by ordinary farmers on adjoining ground, of precisely similar nature, cultivated by their ordinary modes of procedure. He did not know much about the Madras Presidency, and, no doubt, the Marquis of Tweeddale seemed to be more successful; but in Bengal he had never known an instance of scientific agriculture succeeding. He made these remarks in vindication of the native method, which, it seemed to him, was remarkably

> good. The tendency of people who were accustomed to a high system of cultivation, when they went to India and saw the land cultivated in a simple way, was to say that it was very bad, that the outturn was not so great as was obtained in England, and ought to be enlarged. But most people, when they had been in India some time, changed their opinion in that respect.

Anything more misleading than these remarks by Mr. Cotton, concerning the so-called 'model farms' started by Sir George Campbell, could hardly have been uttered. With his usual energy, Sir George determined to make a beginning in the way of agricultural improvement in Bengal, and we are disposed to forgive much to a man who, in his impatience of the delays that characterize all reforms in India, attempts to accomplish by an 'order', what can only be attained by careful preparation of the conditions of success. The model farms which Sir George opened in all directions—some dozen in number—were an absolute burlesque, as Mr. Cotton must know well enough for they were opened under his administration. There was not a rational hope of any kind to be entertained in connection with them; and when the writer of this notice succeeded to their charge, he closed the whole of them, except the Poosah farm. Without a man in the whole Government, who knew anything whatever about agriculture, and without a single practical agriculturist to take charge of any one of the farms, Sir George suddenly ordered a dozen district officers to open a dozen model farms, under any amateur superintendence that could be laid hold of, or none at all. To speak truthfully, there was no 'opening' of any *farm* at all, anywhere. District officers were required to find land where there was no land, and to begin to 'farm', where there was no one who knew anything about 'farming.' No one dared disobey what the peremptory L. G. ordered, and so what were called 'farms' got some sort of scratch existence on the records, but never got into substantial form anywhere. The whole thing was a screaming farce, to make men hold their sides with laughing. And Mr. Cotton gravely tells the Society of Arts, that "all the model farms in Bengal had failed in a financial point of view." The honest fact is that there never *was* such a 'farm' anywhere in Bengal, and no more amusing burlesque could be written, than an exact story of what the so-called farms really were. "They were started with every prospect of success," says Mr. Cotton. If he had said, that they were the most grotesque parody of farming, ever yet seen upon the earth, he would have spoken truly. Distracted collectors were ordered to find land and begin to farm, and Rs. 2,000 say allotted them for the purpose. The distracted collector acknowledges the order, and writes to the Secretariat to be told what he is to sow and when, as he himself knows nothing of practical agriculture. The distracted Secretariat writes to the omniscient Board of Revenue, and asks *them* to decide what is to be sown. The Board in its turn, writes to the Commissioner of the division for guidance on the subject, and the Commissioner writes straightway to the very Collector who had started the enquiry. to give the instructions, for which he had himself appealed to the Secretariat! It was a screaming farce from beginning to end, and we shut them all up, hoping that the kind Heavens would forget the story altogether. And here is Mr. Cotton assuring an English audience, that model farming in India is a mistake altogether, the thing having been tried in Bengal and failed! Had Sir George Campbell but devoted the Rs. 100,000 or Rs. 150,000, which in his impatience he threw at the heads of the distracted collectors, to bringing out a practical and scientific agriculturist from the Cirencester College, as we begged him to do, and as he afterwards intended to do, when the Behar famine arrested the project, and had he opened a single experimental, not *model* farm, under his charge, *that* would have been an experiment worth making. And he would have made it, had he remained in Bengal. When Sir Richard Temple came in, we tried to induce *him* to do so and failed. He had his own ridiculous hobby to spend a lakh or two upon, and so started the *Statistical Reporter* to regenerate Bengal 'farming' and everytning else, by producing acres of raw figures every month in tabulated form, that had about as much real statistical value in them, as if the figures had been shaken out of a bag upon the paper. Sir Ashley Eden wisely put an end to that folly, and the enterprise of the local government in the way of improving the agriculture of the country, is now reduced to a modest subscription of Rs. 55 per month to the *Indian Agriculturist* for 55 copies of that periodical. But let not Bengal wince under the disclosure, for its enterprise is heroic compared with that of the Imperial Government of the country. So deep is the sense entertained by the Supreme Government of India, of the importance of agricultural reform in the country, that it positively subscribes Rs. 2 per month to the *Indian Agriculturist*, for the enlightenment of the people upon the condition and the necessities of their husbandry. We feel a grim satisfaction in recording it, and ought not to forget to inform the world, that when we started the *Indian Agriculturist* to take the place of the *Agricultural Gazette of India*, which Earl Northbrook had suppressed—that excellent nobleman sent a circular to all the local Governments expressing his hope that they would not subscribe to our new paper. Astounding as the fact must seem to the public, it is true; and one of Lord Lytton's earliest resolutions concerning the public press, was a generous circular to the same Governments to remove the bar that his 'small' predecessor had thrown across the path of the *Indian Agriculturist*. We had no intention of saying all this, when we began with Mr. Cotton and the model farms, but it may as well 'out.' Magnanimity, as we often say, is unknown in the modern rule of India. Were Lord Lytton unhampered by the traditions that stifle the departments, he would have done much we believe, to bring vital healthy freedom and breadth of view, back into the Government. Earl Northbrook sitting down to frame a circular to the local Governments, begging them not to subscribe to the *Agriculturist*! This is what we had come down to, when Lord Lytton came amongst us. And observe how the spirit is reflected in Mr. Cotton's assurance to the Society of Arts, that nothing can be done to improve Indian agriculture. Has not the infallible bureaucracy already tried it, under Mr. Cotton's own hand, and what can the man do that cometh after the king! "I tell you," says Mr. Cotton, "that *we* have tried it, "and that Indian agriculture cannot be improved. Most people "when they first go to India have this silly notion that Indian "husbandry is poor and inefficient, but they change their "opinions after they have been in India some time. Have not "I, from the very 'holy of holies' superintended model farms "in Bengal and I tell you it is hopeless: yea, though you "spend £10,000 a year on a *Statistical Reporter* to help you, as "I have done." Official infallibility, refusal to acknowledge error or failure, and Rs. 2 a month to the men who tell you that the agriculture of the country must, and shall be, improved though every model-farm in the country should burlesque the effort, as it was burlesqued in this presidency. We would undertake at once, to establish an Agricultural department in India, that would revolutionize its husbandry in less than a generation of years, and at no great cost either; but we would have no distracted collectors dragged into half-hearted co-operation with it, nor infallible officials, like our friend Mr. Cotton, to croak failure before the experiment were even begun. We would have a man like Robertson, of the Sydapet-farm, for our Director, and a clear business head that knew how to face expenditure, and to be patient of success. Mr. Cotton's infallibility is not likely to go far in England, but it would be most deplorable for the notion to get abroad there, that we have really tried to improve the husbandry of India, and failed. We have yet to make the effort; and instead of failure there will be a grand success to reward us at the close.

THE BENGAL LAND QUESTION.

THE *Bengal Land Question* (*Englishman* Office, 1878) is a pamphlet that has been lying on our table for some weeks past and soliciting our attention. Who the writer is we are not told, nor has the pamphlet a preface, or introduction of any kind. Its contents are a sufficient *raison d'être*, however for its publication, and they who wish to see the ryot's side of the question vigorously and perhaps not unfairly stated, cannot do better than procure a copy of the pamphlet. The writer travels over the well known story from the Cornwallis settlement down to Sir Richard Temple's projected Rent Law, as shadowed forth in his minute of 26th April 1876, which he rejects utterly; and in its room proposes a Law based upon the following suggestions:—

Firstly.—The common tenants, though they are to be liable to enhancement of rent, should have the same privilege which an occupancy ryot possesses, namely, that the zemindar shall not be able to oust them on any ground whatever.

Secondly.—Though the common tenants are to be liable to enhancement of rent, sufficient allowance should be made to them to meet the risk of season, and the enhancement should be made according to a fixed proportion.

Thirdly.—The occupancy ryots should be liable to enhancement of rent, only when the zemindar helps them to improve the land, when for instance, he gives them a large plot of land to till, or lends them a capital sufficient to carry on agriculture on a large scale.

Fourthly.—Those ryots who have held at fixed rates for more than twenty years, should not be liable to enhancement at all.

Lastly.—There should be a uniform measuring rod for all the parts of the country.

By common tenants, the writer means tenants-at-will, and he demands for them first of all, that "the zemindar shall not be allowed to oust them on any ground whatever." This is loosely expressed however, and is not what he really means. What he really means is that every cultivator shall have 'occupancy' right, or the privilege of holding at a fixed rental, subject to enhancement only under specific conditions prescribed by statute. In other words, the radically vicious status, as Mill calls it, of tenant-at-will, is to be everywhere abolished, and every man actually cultivating land shall have the right to hold it for ever, at whatever rental he may happen to be paying, subject only to such enhancement as the owner may be entitled to exact, under statute prescription. In the *second* place, and after the whole cultivating class are thus made occupancy ryots, these occupancy ryots are to have a certain annual reduction of the rental, guaranteed to them by law for the uncertainty of the seasons. There is the same looseness of thought here, as there is plainly no reason why the risks of season should not be taken into account, in fixing the rental itself. Why prescribe a nominal rental of Rs. 20 with a reduction of 10 per cent. for bad seasons, when by a single intention we may make the real rental Rs. 18 at once. The *third* stipulation is more important a good deal, and would oust the zemindar from all share in the increased value of the land—that is not the fruit of his own enterprise, skill, or capital. The unearned increment of the land, as Mill calls it, is to belong to the cultivator, not to the owner. That the cultivator has any better title to this increment than the zemindar, it would be hard, we think, to make out. *Primâ facie*, and if there is any meaning in 'ownership' at all, any accidental increase in the value of the thing 'owned,' ought one would say, to go to the owner of the thing, and not to the mere 'user' of it. If we hold that the owner has no right to any accidental of incidental increase in the value of the thing owned, the mere 'user' of the thing can certainly show no better right. This unearned increment, says Mill, obviously belongs to society, by whose help and protection the increase has become possible. It is carrying tenant-right to very extreme lengths indeed, to demand that the tenant shall be the owner of an increase, for which he has no more worked than the landlord. In the *fourth* place, no tenant who has paid the same rental for 20 years, is to be liable to any enhancement of the rent at all. Here again, the claim is, that the tenant shall step into the shoes of the owner and that the interest of the latter in the lands he is supposed to own, shall be simply a fixed annual charge upon the profits, without respect to their increased value. It is as well perhaps that these extreme views should be stated at length; but the writer can hardly suppose that advocates of tenant-right like ourselves, are prepared to oust the zemindars from the ownership of the land, in this summary fashion. If the quarrel between the zemindar and the cultivator, is to be settled wisely, it will be by compromise and not by a revolution. We are desirous to see the tenant properly protected; but we suspect that in the eastern districts in particular, the occupancy ryots are well able to protect themselves, whatever may be the condition of the tenants-at-will. And the writer of this pamphlet unwittingly confirms us in this belief, by the tables in which he proposes to show how miserable the condition of the ryot really is. The tables he gives are these:—

Crop, its quantity.	Value.	Expenses.		Income.
Paddy Amun, *Aus* 25 maunds. Besides *Amun* and Aus crops, there are *Pygha* boro and *Bawa* paddies.	£ s. d. 3 2 6 s. d. 2 6 per maund.	Rent Day laborers Plough Seed Oxen by hire	£ s. d. 0 16 0 0 13 0 0 4 0 0 2 0 0 4 0 1 19 0	£ s. d. 1 3 6
Jute 25 maunds	£ s. d. 6 5 0 s. 5 per maund.	Rent Day laborers Oxen by hire Seed Plough	£ s. d. 1 4 0 1 10 0 0 4 0 0 2 0 0 4 0 3 4 0	£ s. d. 3 1 0
Til (Linseed) 7 maunds	£ s. d. 2 2 0 s. 6 per maund.	Rent Day laborers } Oxen by hire } Seed, plough	£ s. d. 0 10 0 0 6 0 0 2 0 0 18 0	£ s. d. 1 4 0
Mustard 7 maunds	£ s. d. 1 15 0 s. 5 per maund.	Rent Day laborers } Oxen by hire } Seed, plough	£ s d. 0 10 0 0 5 0 0 2 0 0 17 0	£ s. d. 1 18 0
Kolye 20 maunds	£ s. d. 2 0 0 s. 2 per maund,	Rent Day laborers } Oxen by hire } Seed, plough	£ s. d. 0 10 0 0 4 6 0 1 0 0 15 6	£ s. d. 1 4 6
Safflowers 2 maunds	£ s. d. 6 0 0 £ 3 per maund.	Rent Day laborers } and seed } Ploughing	£ s. d. 0 14 0 1 10 0 0 1 0 2 5 0	£ s. d. 3 5 0
Sugarcane 25 or 30 maunds	£ s. d. 5 or 6 0 0 @ 0 1 0 per maund.	Rent Day laborers, &c. ...	£ s. d. 0 16 0 1 10 0 2 6 0	£ s. d. 2 4 0 or 3 14 0

Thus it appears that the ryots' average income in paddy, linseed, kolye and mustard crops per acre is £1 3s. 6d. plus £1 4s., or £1 3s. 6d plus £1 18s., or £1 3s. 6d. plus £1 4s. 6d; in other words, £2 7s. 6d. or £3 1s. 6d., or £2 8s.; and that in the case of jute, safflower or sugarcane his annual income per acre is £3 1s., £3 5s., or £2 or £3 11s. His average income varies therefore from £2 7s. 6d. to £3 14s. Generally he holds five acres, and his total income is consequently between £11 17s. 6d. and £18 10s. Deduct from this the cost of his own labour which, at the lowest, will come up to £2 a year; deduct also the interest that is to be paid to the mahajan, who furnished him with capital, and his net income will be between £6 and £16.

The paragraph is not only quite unintelligible, but we are obliged to demur to the whole account. The day-labourers' charge in peasant farming, is a fiction altogether. The writer makes out the account, precisely as though the ryot were a capitalist farmer, instead of being himself the day labourer, or peasant farmer, that he really is. The account should therefore stand thus:—

Gross produce of seven acre farm—				£ s. d.
1	Acre of	Paddy	...	3 2 6
1	,,	Jute	...	6 5 0
1	,,	Linseed	...	2 2 0
1	,,	Mustard	...	1 15 0
1	,,	Kolye	...	2 0 0
1	,,	Safflower	...	6 0 0
1	,,	Sugar-cane	...	5 10 0
				£26 14 6

Rent and expenses of cultivation—

	£	s.	d.	
Paddy	0	18	0	
Jute	1	6	0	
Linseed	0	12	0	
Mustard	0	12	0	
Kolye	0	11	0	
Safflower	0	14	0	
Sugarcane	0	16	0	
				5 9 0
Nett profit ...				£21 5 6

What possible business have labour, ploughing, oxen hire in the accounts of a peasant farmer with five to seven acres of land; when we want to find out the return he gets for his labour, and ploughing, and oxen. If he is to charge a money price for these items, he is then paid already, and the remainder will be the nett profit he has at the end of the year, after paying all expenses and his own keep. If the ryot with seven acres of land, gets a crop of £26 14*s.* 6*d.* off it, and his rent absorbs £5, and the seed costs but 9 shillings, he has then £21 5*s.* 6*d.*, or say Rs. 200 a year to live upon. If he rental averages but Rs. 7 per acre, and the produce is worth Rs. 36 per acre, the ryot must be very well off, and we suspect that he *is* well off, in Eastern Bengal at all events. We should like to see what the writer of the pamphlet has to say in reply.

THE BANGALORE EXPERIMENTAL FARM.

(BY AGRICOLA.)

THIS farm, at present under the management of Mr. F. E. Harman, whose scientific and agricultural attainments are vouched for by the long array of seven letters he places after his name, is situated on the southern side of the cantonment, on a piece of land purchased in 1873, for twenty or thirty thousand rupees, on the recommendation of Mr. Robertson, the well-known head of the Madras Agricultural Department. Much of the land had formerly been in the hands of native gardeners, and it is overburdened in some parts with wells, dug in far too close juxtaposition for any practical use. The waste was a necessary result of numerous separate holdings of very small size, in which the cultivators, according to the usual custom of the native, wasted an enormous volume of water in damaging his crops by over-irrigation. The quality of the land is in some respects all that could be desired, but yet, for testing improved practices and systems as to their general adaptability to the wants of the country, it is so much more fertile than the ordinary soils of Mysore, that the selection of the site, must be considered to have been made under a false impression of what was required, or from deficient information regarding the country.

Entering the farm from the high road, which forms its northern and western boundaries, I came almost immediately to the buildings which are very conveniently arranged on one of the highest portions of the estate, on a piece of light soil with a gravelly subsoil, thus furnishing good drainage and ensuring the health of the stock; the slope of the site is towards the south, and the cattle are protected from the N.-E. wind, which is very cold and blows there in November and December with considerable violence, by some trees, and the wall of a neighbouring compound, this however was not found sufficient, and eastern walls, which have a most untidy appearance have been run up around the cattle boxes for the same purpose.

The buildings are arranged in the form of a rectangle, having at the north a granary, erected on stone pillars, 8 or 10 feet above the surface of the ground, thus furnishing accommodation below for the storage of hay, and space for the protection of carts, &c. from the weather. The granary is reached by a flight of solid stone steps, from the inside of the yard, and is simply a long room, built of brick and mud, with a stone slab floor and a tiled roof, having doors at either end and on the south side (the entrance); windows are also let into the walls at convenient distances, and the whole building is very well adapted to the purpose for which it is designed, being dry and airy, and well protected from white ants. At right angles to the granary building, which is 70 feet long by 17½ feet broad, on either side at a little distance (about 10 or 12 feet) from each end of it two ranges of covered cattle boxes extend, each 100 feet long by 20 feet broad, and affording accommodation for 40 cattle, but, although this is their nominal complement, the space allotted per head is such as would allow of the number being greatly increased. The boxes are formed by the excavation of a pit about 2 feet deep, the exact size of the building, which is walled round by a brick wall, rising, excepting at the gables which are carried right up to the roof, about 3 feet above the level of the ground outside, and furnished with spaces for entrance into each subdivision or box. The roof is supported on stone pillars, each a single slab, and consists of good timber, and pantiles, keeping off the rain and preventing the manure underneath from washing. Into the pillars, by means of holes cut through them, bamboos are let, thus effecting the division of the building into boxes 10 feet by 10 feet; in these boxes the cattle are kept at night, and their solid and liquid excrements are thus most carefully and efficiently preserved, there being no danger, as has been also proved at the Sydapet farm, of injuring the hoofs of the cattle by the manure heating, decomposition going on slowly, and from the constant moisture preserved in the mass, no great heat ever being generated. This system of boxes although at first sight too expensive, is one which should be adopted universally by the Indian ryot; the want of capital could easily be got over by loans under the Land Improvement Act.

In continuation of the western cattle shed, there is a small enclosed space under the same roof for the storage of implements, &c., and beyond this a house for the farm overseer is being erected. On the eastern side, below the cattle boxes a roadway has been left, and then comes a small building erected originally as a piggery, but now converted and enlarged into a smith and carpenter's shop, where all sorts of improved implements would be made, had not the short-sightedness of the Mysore Government cut off all funds for that purpose, which is the more foolish because all such expenditure is always recouped by the sale of the implements at cost price. In the centre of the yard is a large scale used for experimental work, an oil-mill of the country, used occasionally only for crushing ground-nuts (*arachis hypogæa*) and other oil seeds. The general appearance of the yard, when it was visited, was very unworkmanlike, partly owing to the building which was going on, but more especially from the unsightly look of the walls, half finished to all appearance before the cattle boxes; surely some neater and cleaner, and as efficacious a screen could have been erected?

Under the granary was an eight foot drill, by Ransomes & Sims, which is used for sowing nearly the whole of the farm. Although it cost about Rs. 300 the investment is a most economical example for any one who has a holding of 150 acres or more to follow, the saving in seed, over that used by the ryot is about, 80 per cent., which, on an area such as is mentioned, would soon recoup the prime cost or pay a most handsome interest on the first investment. A winnowing machine, purchased at the opening of the farm, is not used, as Mr. Harman considers that it is not so economical as the ordinary practice of winnowing with the wind, this experience is contrary to that of Mr. Robertson at Sydapet, for the latter gentleman believes very strongly in the economy and usefulness of this machine; the conditions of the two experiments are however so different, that there need be no great surprise felt at conclusions so radically opposed being arrived at.

The other implements noticed, were ploughs and harrows, both prong and chain; the ploughs are chiefly of the pattern known as Howard's pony plough, and are found to be very efficient; they are simple of construction, and such as could be made or mended by any smith in any village; they are cheap, only costing Rs. 35, and economical, enabling one pair of cattle to do the work of three and in a far more efficient manner also.

Leaving the buildings and proceeding along the main road through the farm towards the south, after descending a slope for some distance, having on either side, land of first class whitish loamy character, at a cross road, which runs east and west, a block of strong rich deep soil is met with; it was here on this soil that the results detailed by Mr. Harman in the growth of paddy without irrigation-water last year, which have so astounded the intellects of irrigation engineers, were obtained. To any educated and intelligent agriculturist, who has studied paddy cultivation, the results, although exceedingly good, are in no way marvellous; on a good soil if it contains a fair percentage of organic matters, and is deeply cultivated, with 40 inches of rain, paddy can always be grown without irrigation; that is if the rainfall be distributed fairly over the period of growth. Further on, on the same road, a double-mhote was at work, watering some maize crops, which were looking very well; this machine is a modification and an improvement on the one at Sydapet, from which your late correspondent "A. W." of Coimbatore copied those to which he so often referred as his own; it is however worked by two bullocks, for Mr. Harman naturally says that, when he wants to work his wells, he has no pressing work for his cattle, so that he has no object in using only one. There are three of these machines at work on the farm, and it is very satisfactory to learn that as many as nine are being erected in the neighbourhood from this model—a sign of intelligent appreciation on the part of the Mysorians, which is only on a par with the generally advanced state of the province in comparison with the rest of Southern India.

A very fine crop of cholum (*sorghum vulgare*), growing without irrigation on a piece of land only recently broken up, adjoins a large piece of land 30 or 40 acres in extent, which, being under the waterspread of the tank which lies to the S.-E. of the farm, has been left under natural pasture, although formerly it all grew paddy. A piece of maize sown in alternate rows with ground nuts is looking well, on some lighter land at the southern side of the farm, notwithstanding the badness of the season; it clearly shows the efficacy of deep culture in resisting the prolonged absence of rain.

An interesting experiment now being made, in the growth of sugarcane at double the distance apart to what is customary in the neighbourhood will no doubt show the evils of overcrowding; even the widest distance now adopted might I think, be advantageously increased. A series of experiments, with maize, to show the fallacy of the idea that burning cowdung is not an injurious practice, and that the loss of organic matter in that process is the chief loss are also in progress.

The farm is wonderfully clean and free from weeds, but the character of the two past years has been such as was most favorable to attaining such a desirable state of things, whilst it has prevented that morbid craving for results, which always demonstrates the ignorance of Indian officials in agricultural experiments being indulged in or pandered to. So far most satisfactory progress has been made in preparation, and it may be expected that in coming years Mr. Harman may be able to give the public a great deal of most valuable information.

The financial is not the true light in which to look at experimental farms, for they are educational establishments and should be looked up on as such. It is however useful to know what the cost of an experiment is, and it will be seen on reference to the annual reports, that as in all other cases, even those on which the wiseacres of the Bengal Government founded their opinions, that modern agriculture is useless in India, there has been a large expenditure in preparation and that the cost of European supervision precludes the idea of "model" farms ever being financial successes. For an enlightened Government, like that which the Government of India pretends to be, to object to the expenditure of say 1 per cent. of their land revenue, on an endeavour to improve the agriculture of the country is so monstrous, that it is wonderful how the opponents of agricultural reform have the countenance to maintain their absurd position. In an agricultural country, rulers were they elected, who are ignorant as babes unborn of agricultural science, would soon learn to study the subject if they wished to maintain their position, but being forced on India, her rulers remain in their blissful state, regardless of the rapid marches the country is taking to bankruptcy, exhaustion and ruin, whilst they [illegible] themselves at Simla, or elsewhere, complacently congratulating one another on the "Moral and Material" progress of the Empire, they have been appointed to misrule.

Bangalore, June 20, 1878.

AGRICULTURAL COLLEGES.

The neglect with which, as a Government, we have persistently treated the great subject of Agricultural reform throughout the whole 120 years of our rule, is one of its most curious, and at the same time discreditable, peculiarities. Seeing that the State is the great Landlord of the country, and possessed of hardly any resources but such as exist in the land, we might naturally have supposed that it would have directed its attention, at a very early stage of its rule, to the great question of the husbandry of the people. Whether it has been that the task was distasteful in itself or that it was thought beyond the province of the State, it is a fact that the State has received every proposal to grapple with the subject, in a spirit almost hostile thereto. That Landowners should learn practical agriculture, one would suppose to be self-evident In his great *Book on the Farm*, Mr. Stephens writes:—

> "Did land *owners* but learn practical agriculture, there would be no want of pupils in our model farms. The expectant land-owner, should undergo tuition in his profession. To acquire a knowledge of the duties of a landlord, he considers it unnecessary to undergo initiatory tuition He conceives that these duties may be learned at any time, and seems to forget that the conducting a landed estate, is a profession as difficult of thorough attainment as soldiership, or legal lore. It strikes everyone as an incongruity that a country gentleman should be unacquainted with country affairs. Is it not strange that he should require inducements to learn his hereditary profession, to become familiar with the only business which can enable him to enhance the value of his estate and increase his income."

Mutatis mutandis, every word of this applies with peculiar force to the Government of India; and yet we have never been able to interest it in the question sufficiently to induce it to establish either 'model farms' or Agricultural Colleges in the country. The so-called model farms that have been attempted, here and there in India, have been either started on a footing so irrational as to make them a burlesque of such institutions, or have been so starved in their working, that the money spent upon them has been thrown away. The notion that a successful model farm, means a farm that pays its way and is remunerative, exists to this hour in every Secretariat of the country, and is of course fatal to the very idea of what such farms require to be. In Bengal, we make no pretence to the possession of such a farm, still less to an Agricultural College; and it is only in Madras, we think, that the Government shews the least belief that such institutions are wanted in the country at all. Had we ruled India wisely, not an officer would ever have been appointed to "Settlement" work, who had not graduated at an Agricultural College. We do the most irrational things in India, and then wonder at our want of success. We have frequently pointed out how desirable it is that officers engaged in the work of the Survey and Settlement of land in India, should go through a novitiate in the Cirencester, or some other agricultural college, to acquire a thorough knowledge of agriculture, for their guidance in their work. The suggestion is one of common sense, and we are not surprised to find that it was made 26 years ago in Bombay, by the late Professor Green, who wrote as follows:—

> "The whole system of revenue management is susceptible of many improvements. Very evidently, it is never made sufficiently a profession. This is a conviction that grows upon us the more, the further we read. Whatever Persian or Sanskrit one might sacrifice in their attainment, we should certainly insist, as the qualification for a Collectorship, or for any other revenue appointment, on a first-rate course of scientific agriculture in one of our Agricultural Schools at home, and a thorough acquaintance with one or two of the best writers on Political Economy.
>
> "The more we read of these reports, the more impressed are we with the conviction that we have in them the productions of gentlemen fairly educated, and for the most part well intentioned, but whose chances of usefulness to the country would be greatly increased, were they educated with much closer reference to their future employment, and taught to consider it a profession requiring the same attention from them which a lawyer pays to his cases, or a physician to his pathology and his practice of medicine."

We have repeatedly made the same suggestion of late years, but in vain. The Settlement officers of India ought to be a body of scientific and practical agriculturists, at the head of a system of model farms and Agricultural Colleges, turning out every year large numbers of young men, qualified to act as land-stewards or bailiffs; but you cannot get the Government of India to see it. It is a Government of routine, a Government that moves in established grooves, and that has come at last to look even upon the suggestions of common sense, as Utopian, crotchetty, visionary. The Settlement officers themselves agree with us that they want a practical knowledge of agriculture to fit them for their work, but the Government cannot see it, vital as the subject of the land is to us.

THE LOCUST PEST.

THE Government of Madras is waging ineffectual war against the locust. The presidency had barely escaped from the double plague of a famine and a famine Delegate, when the plague of locusts was sent to eat up every green thing that gave hope of better times, and of a fuller subsistence than the Temple ration. Unhappily, Sir Richard's services were not there to starve the locusts out of the land, and their armies have swept over the country in myriads, not only devouring but breeding as they went. An ingenious doctor of those tenebrific regions, proposed, as we saw the other day, to employ the poor to catch them, by way of relief work, and to use them as manure. He also pointed out the necessity of gathering and destroying the eggs, after the flight had passed away. The Madras Board of Revenue read the ingenious doctor's proposals, and resolved that they were impracticable. They then turned for help to the Secretary of the North-West Provinces, but to no purpose. Nobody in India could tell them how to get rid of the locusts. In fact nobody in India seemed to know anything about the insects, except that they were one of the ten plagues of Egypt, and the third of the plagues of Madras, *viz.*, the drought, the delegate, and the locusts. To get any knowledge about them at all, it was necessary to go to America. They contrive to order most matters a good deal better there, than in this poor bureau ridden India, and one institution they have which we shall never have a Government enterprising enough to give us—is a State entomologist. Or if we do ever get so far as that in India, we may expect, not that an entomologist will be attached to the Department of Revenue and Agriculture, but the creation of an Entomological Department with a Director-General and the usual costly machinery. In the meantime the little information about the genesis and habits of the locust which Madras has been able to obtain, has been got for it by the Superintendent of Government Farms, from America. The State entomologist of Misouri, though he does not tell us how to destroy the insect, tells us with interesting minuteness how it is generated. Our ingenious doctor's proposal to gather the eggs would apparently be difficult, for they are deposited well under ground, usually about an inch deep, and the orifice by which they are inserted is carefully covered up by the parent, in such a way however, that the newly hatched insect can easily break out. It seems it is easier far to catch the young locusts, than to gather the eggs. It has to go through a series of four months, before it reaches the perfect, winged state, during which time it hops rather than flies. It can however, move considerable distances even before it attains the fully winged state. Mr. Pinto, Tehsildar of Combatore, found patches of ground covered with the young and wingless locust, where no flight had been known to alight At the approach of any sound, they moved off rapidly in the opposite direction. One day Mr. Pinto, with the help of the ryots, attempted the destruction of two of these swarms, but killed only two or three basketsfull. Evidently locust hunting, would not pay as a famine relief work. Next day he tried to destroy them by fire. He made long rolls of straw, and had them placed round the swarms in a close circle, and kindled. Not being able to fly high, the young insects would all have been burned, could the circle of flame have been kept unbroken, but this was not easy, and wherever a momentary break occurred, out burst the hoppers. However, six or seven basketsfull were killed, and specimens forwarded in spirits to the Collector, who reported that the experiment was tolerably successful, but too costly and laborious. The Collector forwarded Mr. Pinto's letter to the Board of Revenue; the Board of Revenue sat thereupon, and submitted it for the information of the Government; and the Government solemnly ordered that the matter be recorded. One can hardly help deriving some amusement from the persistent and futile efforts of the Madras Government to find a way of destroying its locusts; but the matter is unfortunately serious enough. Perhaps the Famine Commission will look into it, not having quite enough to enquire into, as it is.

A NEW FODDER TREE.

A QUANTITY of the seeds of a tree, called the *Pithecolobium Saman* has lately been forwarded to the Government of India by the Home Government, with a request that the seeds may be widely distributed wherever facilities exist for their being properly cared for. The tree which is a native of Jamaica, appears well adapted for park and avenue planting, but its principal advantage to India, will probably be found in the use of its fruit as a fodder for cattle. Mr. Jenman the Superintendent of the Castle-town Botanical gardens, Jamaica, gives a very interesting and graphic account of its general habit and custom. It resembles the English Oak in many respects. The trunk is from three to six feet in diameter, generally short, and branched a few feet from the ground. Trees are not infrequently seventy feet high, the diameter of whose horizontal branch expansion is over 130 feet. "The shade which this tree affords is of light lifesome character "with gleams of sunlight stealing through, and flitting about as "the branches move with the breeze. The leaves and leaflets rigidly "close together at night, thus admitting of the free descent of dew "to the ground, where grass grows close up to the trunk and as "freely within the overshadowing of its wide branches, as with- "out. The fruit is a bright dark-colored pod when ripe, six to "ten inches long, nearly an inch thick; in substance consisting of "amber colored pulp. These pods are borne in great profusion, and "hang prior to their maturity dangling in clusters from every branch- "let. As they ripen they drop to the ground and are picked up "and eaten with much relish by all stock, even sheep and goats. Cat- "tle may be seen lingering about the trees waiting for the passing "breeze to shake the fruit down. Its excellent quality as a fodder "is evident by its fattening effect. Stock having access to it improve "markedly during the time it is in season. From the sugary nature "of the substance of the fruit it will keep a good while packed "after maturity. It is therefore often gathered on the pens, packed "in barrels and kept for use till the dry early spring season has "parched up grass and made herbage scarce. * * * Hot plains "having an annual rainfall of from 30 to 60 inches appear best "adapted for its successfull growth either spontaneously, or by cul- "tivation" —while a maritime influence is particularly favourable to its development.

As regards its cultivation in India, Dr. Birdwood thinks it likely to flourish luxuriantly everywhere above the western ghats of the Deccan; on the Coromandel Coast; across Central India from the mouth of the Nerbudda and the deltas of the Mahanuddee and Godavery, in the Lower and North-western Provinces, and westward of the latter, along the southern slopes of the Himalyas to the confines of Cabul, while it is less likely to flourish in the table land of Mysore, Rajputana and Sind, although it might be tried on the banks of the Indus. The Secretary of State attaches so much importance to the cultivation of this tree in India that he has asked to be informed of the success which may result from the experiments made with the seed now sent out. As a fodder for cattle in districts affected by famine, the fruit of the tree would probably prove invaluable.

EDITORIAL NOTES.

IT is stated that Mr. Gordon, Chief Commissioner of Mysore seriously contemplates the formation of a school of agriculture at Bangalore, on the model of the one at Cirencester. With this object in view, Mr. Harman, the Superintendent of the Experimental Farm, has started on a tour through the Province, exhibiting an English plough to the ryots, and explaining to them the very great advantages which they are likely to derive from its use. Mr. Harman has accordingly shown the plough in some Districts, but with what success, we have not yet heard.

"As the rose breatheth sweetness from its own nature, so the heart of a benevolent man produceth good works." This beautiful remark of an ancient Brahmin, holds good throughout all generations. It frequently happens, however, in these degenerate days, that much good is wrought from other motives than those of benevolence; but whatever may be the motive—whether benevolence or pecuniary profit—the community should be grateful if the good result be attained. The efficacy of the oil of Chaulmoogra in alleviating certain terrible maladies (fortunately less common in Europe than in the East) has long been known to Indian physicians. Samples of this oil (expressed from the seeds of the *Gynocardia odorata*) were exhibited in the Paris Exhibition of 1867 in the collection of Indian drugs, and the exhibitor (Kaunnai Lall Dey) states in his descriptive catalogue, that the oil is extensively used in the treatment of cutaneous diseases—especially in leprosy, ichthyosis, and in all kinds of syphilitic eruptions—simple or in combination; taken internally or applied in the form of an ointment.

Mr. R. O. Lepage in "his Papers on the Plant *Gynocardia odorata*" from which the Chaulmoogra Oil is obtained, informs us that the oil has all the power of mercury as a curative agent, without any deteriorating effect on the constitution, and that it is one of the simplest and most powerful alteratives yet made known. It is rather out of our province to investigate matters of this nature, but we trust the remedy will be submitted to a fair trial by the medical profession.

The manner of compiling the pamphlet is certainly bad, consisting merely of extracts copied *verbatim* from various botanical works and from papers relating to the plant *Gynocardia odorata*, and the oil obtained from it; instancing cases of leprosy, &c, in which the remedy has been found effective. It would have been much more convenient for reference, if the author had condensed the *résumé* instead of giving ten different papers in full, involving much repetition. In fact, the arrangement adopted strongly suggests the idea of a trade advertisement with testimonials attached. In our opinion the clearest description of the plant is given in Bently and Trimmens' *Medicinal Plants.* In these days of quackery, when new and doubtful medicaments are constantly advertised, it would be well if some of the old long neglected and well-proved ones were again brought to light, retested, and utilised.

We observe that experiments with leached ashes continue in America to work favorably, and to win friends every year. They have been used for many years by the farmers and market gardeners of Long Island, and later by the same classes in the shore towns of Connecticut, and on the tobacco farms, farther inland. Leached ashes contain considerable quantities of potash and phosphoric acid, which have a wonderful influence upon exhausted soils. The onion-growers make large use of leached ashes, buying sometimes by the thousand bushels. Fruit-growers are much pleased with its effect upon the growth of trees and shrubs, and upon their productiveness. Their effect, we are told, is immediately visible in old pastures and meadows, spread broadcast, as a top-dressing; but they act more satisfactorily if applied to the crops at the time of seeding down. They not only largely increase the crop with which the grass-seed is sown, but their influence is visible for many years afterwards, in the increased yield of grass. A farmer who has used ashes freely for twenty years, upon a hard, worn, granite soil, says they will give an increase of hay, upon a meadow newly stocked, for eight years; and then, if the field is ploughed again, they will show the effect of the ashes for six years longer. He applies about 100 bushels to the acre, on land that he designs to keep in meadow, and about 75 bushels to pasture land. It is particularly satisfactory as an application to the rye-crop, even in so small quantities as 20 bushels to the acre. He has reclaimed a large breadth of old fields given up to the growth of bushes, briers, and brakes, and made it a fine pasture by the rye-crop, and ashes. He considers leached ashes his most efficient helper in transforming an exhausted, worn-out farm, into one of great productiveness, giving a fair reward for his capital and labor.

A larger area of grain will, it is stated, be harvested in the Southern States of America this summer than in any year since 1865. In Virginia, where wheat is only one of the principal cash-producing crops, the farmers, hoping to put money in their pockets, speculated upon the probability of a contest among the European nations by sowing all their available lands with it, in some instances reducing the acreage of tobacco. In view of a possible war on this side of the Atlantic, the planters in the cotton States have also considerably increased their planting of corn and small grain for home use this year. In doing so, they have acted mainly on the motto of "a penny saved is a penny gained," for the high price of grain purchased for plantation use, and the low price of cotton consequent upon a European war, would operate disastrously upon the planter if caught unprepared for the emergency. With the exception of a little damage by hail storms in Virginia and some injury by rust further south, these crops are in the main ripening prosperously, so that the farmers there have a prospect of unusually well filled granaries, while the coloured labourers look forward for a liberal supply of "hog and hominy," on which to make next year's crop.

Ostrich farming, which has lately become one of the great industries of Southern Africa, is quite a modern development. Ten years ago a gentleman named Douglass, residing near Grahamstown, in Cape Colony, conceived the project of what is now known as Ostrich farming. Having experimented with a few wild birds, and found that they would 'lay' in confinement, he next set to work to devise some method of artificial hatching. For three years he met with little success, but finally invented the patent incubator, since when he has prosecuted his scheme in a manner that has made him famous. The farm of Mr. Douglass is situated a short distance from Grahamstown, occupying about 1,200 acres of rough ground, formerly devoted to wool-growing. The country round was, until within a short period, used as sheep-walks, but a deterioration in the grasses rendered it unprofitable for such purposes. The quality is yet, however, sufficiently good to satisfy the ostrich—a much less fastidious creature than the sheep. Ostriches feed exclusively on vegetable substances, grasses and their seeds being a favourite article of diet. For this reason, they are much dreaded by those who cultivate the soil in the vicinity of their haunts; a flock of ostriches will soon make terrible devastations in a field of corn. The birds swallow large stones for the same purpose that smaller fowls do grains of sand—to aid the gizzard in the trituration of food. In confinement, the ostrich has been known to swallow indiscriminately whatever came in its way—pieces of iron, bricks, glass, old shoes, copper coin, or any other object whose proportions are not beyond the capacity of its throat. The instincts of the bird do not prevent it from swallowing the most harmful things; copper coins were fatal in one instance, and a piece of an umbrella in another.

Mr. Robert Elliott writes to the *Journal of the Society of Arts*:—"Is the state of agriculture owing to the poverty of the people? Is the general management of the lands of the country such as is most favourable to good agriculture? Is the state of agriculture owing to causes beyond the control of the farmers; and if so, how can the Government modify these causes? As Mr. Cassels well says, 'It seems to me that the condition' (and circumstances, he might have added) 'of the people is to be chiefly looked to in any inquiries we make into the state of agriculture of a country.' If the Society again takes up this important subject, this is the point to which its attention should be directed. It is of no use to spend an evening, or any number of evenings, in scratching at the back of the tree; the improvement must come from the root. The conditions at the bottom are bad, and are not to be rectified by a thin plastering of English implements and agricultural chemistry."

Our recent remarks about the Indian 'beer' question, have drawn upon us a flood of its literature. There seems, however, little more to be said that may not be more usefully said elsewhere, and by those immediately concerned. Indeed, we are glad to hear that the representatives of the various hill breweries, are about to memorialize the supreme military authorities on the subject. Fortunately for the memorialists, the authority whose opinion will carry most weight, may be trusted to take a sensible and reasonably liberal view of the position, apart from the circumstances that, as a member of the India-Office Council, he was an energetic and consistent advocate, not only for the adoption of hill beer for the Army, but of everything else Indian that could wisely be made available for its use. But next, perhaps, to our own Commissary General, the man of all who could speak feelingly on the Indian beer question, is the official charged with the supply of English beer—the Director-General Home Store Department at home. In a letter before us, he refers to it as "a very ticklish affair—a very troublesome duty which has caused him for years much anxiety." Whilst at one time, Sir George Clerk went so far as to advise that a sum of £20,000 should be promised to any firm in India who would brew good malt liquor that would remain sound for three months in the plains—how completely this problem has since been solved, is notorious. Our Indian brewers now compete for honours at Continental Exhibitions and win them.

It has been very fairly pointed out to us that, the quantity of English beer imported by Government, though still a large item, is decreasing every year. But our contention is that, there is no sufficient reason for it at all. We admit that a considerable number—though only a considerable minority—of the European soldiers still prefer the home-brewed liquor. In the same way to suit the nice discrimination of a similar minority, China tea was wont to be supplied to the Army, long after the general superiority of its Indian grown competitor had been acknowledged by almost every one else. There is, we imagine, a point at which to pamper the whims of the British soldier, is to demoralize him, and surely that point is arrived at when, of two forms of a luxury placed within his reach by the State, he is to be allowed to choose the inferior and indefinitely costlier one. By the bye, what the final cost of the beer imported by Government really is, we doubt if anybody knows. In an official letter from the Commissary-General, written in 1875, he puts it down at Rs. 61 per hogshead, everything included, landed at Lahore. In an office return of a year later, bearing the signature of the Military Accountant-General, it is estimated to Rs. 69 3-4 per hogshead—a very great difference. Even this probably under-estimates the real figure by at least 20 per cent: so, at any rate, as regards the present time. For exchange is taken at 1s. 9¾d. per rupee only, and the loss by condemnation and loss of interest are apparently not included. As a rule, we have no great faith in the work of committees, but this beer difficulty seems a case in which the services of a properly constituted committee might be appropriately employed. Not, however, as we think, to engage in a profitless enquiry into past losses, but to deal with things as they stand—to ascertain, for instance, the quantity, age and condition of the Commissariat stock of imported beer throughout India. The revelations of such a committee might be startling, but they would certainly pave the way to a clearer conception of the merits of the entire question as regards the future.

THE *London Medical Examiner* notices a subject that should be constantly before the Municipalities of India. It says:—The value of trees in a sanitary point of view, in large and overcrowded cities, can scarcely be over-estimated. Apart from the sense of relief and coolness which they impart, their influence as purifiers of the atmosphere, is almost incredible. It has been calculated that a good sized elm, plane, or lime tree, will produce 700,000 leaves, having a united area of 200,000 square feet. The leaves not only absorb deleterious gases, but they exhale oxygen. They must therefore be of immense benefit, in overcrowded and unhealthy districts. When to this is added that trees modify temperature, promoting coolness in summer and warmth in winter; also that they purify the soil below as well as the atmosphere above, we have a very powerful sanitary argument for tree planting.

IN November last the Madras Government forwarded to Her Majesty's Secretary of State for India a sample of the jalap root grown in Ootacamund, which, on receipt in England, was submitted for valuation and opinion to two of the leading firms of London drug-brokers, and also to a firm of pharmaceutical chemists. The reports of these experts have been communicated to the local Government, and are considered sufficiently favourable to warrant an attempt being made to introduce the Ootacamund product into the western market. The Secretary of State has suggested that the experiment of growing medicinal plants in Ootacamund should be encouraged as much as possible, as, if successful, it may be the means of hereafter creating a permanent industry which will prove valuable to the country.

IT was lately recorded in some of the District *Gazettes*, that certain precautions may be adopted by ryots to prevent blight in seed grain. The Collector of Chingleput has deemed it expedient to warn ryots that sulphate of copper, which was used for this purpose, is very poisonous, and that though grain grown from seed which has been treated with it, is not at all injurious, no grain which has been once wetted with solution of sulphate of copper, can be used as food for either human beings or cattle of any kind.

WE quote the *Hindoo Patriot*:—

"If the transfer of the occupancy tenure be declared absolute, the zemindar will be deprived of his natural right to select his own tenant, a right which he admits is exercised by the English landlord which was exercised by the Indian landlord in the Mahomedan days, and which he would see maintained in its integrity where the State is the landlord. Our contemporary is quite right in saying that the State ought to have the privilege of selecting its own tenant, but he ought to be consistent; he ought not to blow hot and cold in the same breath. What is a just right in the English landlord and the State landlord in India, ought to be recognised as such in the Indian landlord."

Where, or when, have we ever said that the occupancy ryot should be allowed to sell his holding to whom he pleases? We maintain his right to sell, against the zemindar's denial of that right; but we think it very desirable that the zemindar should have the right to stipulate that the buyer shall not be a middleman drone but a *bonâ fide* cultivator. What the zemindar wants, is to prevent the ryot selling at all: a somewhat important difference. The zemindar should have the full right to prevent the sale of the land to any one but a *bonâ fide* cultivator; but what he wants, is to confiscate the occupancy right to himself, and he is bent upon this selfish pursuit everywhere. It is of no use for the *Patriot* to attempt to throw dust in our eyes. We know well what we are saying, and what the zemindar really wants, and what he must not be allowed to get. Our contemporary professes to fear, that if the ryot is allowed to sell his occupancy, the land will inevitably go into the hands of the *mahajun*.

> "The mahajun or other men of capital may, if the occupancy tenure becomes transferable, absorb all holdings of that description, and under the *bhag-jote* or *nij* system of cultivation, reduce every cultivating ryot to a mere day-laborer. Will the transferability of the occupancy right, then, benefit the cultivating class? It will simply pauperize the mass of the population, and necessitate a poor law for the country. We beseech our rulers to pause and consider. If they take a leap in the dark, they may break their own legs, and those of the poor ryots too."

It matters not one whit, whether it is the *mahajun* or the zemindar, who makes a slave of the ryot. The State must prevent either of them doing so. The *Patriot* will not hear of the *mahajun* becoming the slave owner, but sees no objection to the zemindar. We object to both, and insist upon the ryot being protected against both.

INTELLIGENCE has been received in Jamaica, that there is likely to be a very serious falling off in the sugar crop of Cuba. This news gives great satisfaction to the Jamaica planters, who, as they happen to have been favoured with good seasons, are likely to have more than an average crop, and calculate that if Cuba is unable to furnish her full quota of the world's supplies, the stocks will be reduced and prices will in consequence go up. On the other hand, the planters, it is stated, are dissatisfied with the result of their representations to the Colonial Office on the immigration question, and still maintain that without the aid of a very extensive coolie population from India it will be impossible to carry on sugar cultivation much longer in the island. The law lately passed with the view of helping them out of their difficulties, under which they are relieved of a debt of £90,000 which they incurred for immigration, and are provided with a fresh loan of £50,000—the debt of £90,000 and half of the £50,000 to be paid out of the general revenue, thus taxing the general public for the benefit of the planters—fails to content them, and they have, it is said, forwarded a protest to the Colonial Minister against the measure.

THE *yield* of wheat to the acre in California is wonderful, considering the slovenly methods of farming. It averaged about twenty bushels to the acre in 1866; but it is nothing uncommon to see sixty and seventy bushels harvested to the acre, on large fields, and instances are well authenticated of land producing as high as eighty-three and eighty-four. Cases are on record of even more. The average yield is undoubtedly decreasing, as the soil becomes exhausted, in the older sections of the State, by constant cropping with wheat year after year. The quality too, degenerates under this bad system. One singular feature of Californian wheat-raising is the "volunteer" crop. Land sown one harvest year will "volunteer" a half-crop next year, without any care, further than to protect it from cattle; and even the third year may produce a crop worth harvesting. The "volunteer" grain will be foul; but it usually ripens early, and partially makes up for its quality by coming into market before the main crop. The mildness of the winter protects the seed, sown by nature in the cracks of the ground, from destruction; and the first "volunteer" crop sometimes averages twenty-five or thirty bushels to the acre. California wheat, as a whole, is peculiar for its whiteness and hardness. It is not remarkable for its "strength" or glutinous quality. Its whiteness gives it an especial value in New York and Liverpool. It is so hard that the mills of the interior are compelled to wet it freely before grinding. This quality protects it from insects, renders it peculiarly safe for a sea-voyage, and makes it doubly valuable for mixing with the softer varieties in England and the Atlantic States.

THE farmers of Nebraska and Minnesota are using corn for fuel. This, at a first glance, seems very shocking. When we think of the starving multitudes in all countries, and the famines that are destroying thousands and even millions of human beings, our first impulse is to consider that the American farmer who boils his kettle and warms his hands at a fire of corn cobs, is guilty of something little short of sacrilege. But when the matter is worked out in figures, it appears that the farmer is right, and his critics altogether wrong. In the first place, corn makes a capital fuel, and considered *simply as fuel, it is not wasteful. The only question* is whether it can be right in any case to burn up an article of food. Now, the Western farmer argues that he must have a fire in the winter, and we must, in all fairness, concede it. To feed his fire he must have either coal, or wood, or corn. Suppose he goes for coal, he must sell his corn to buy it. He loads a couple of tons of corn and takes it ten or twenty miles to a coal store, sells it for six dollars, and buys half a ton of coal with the money, puts it on his wagon and goes back again, being out of pocket some few dollars by his waste of time and the labour of men and horses. The same reasoning applies to wood, which is just as scarce in these parts as coal. The question for the farmer is whether, out of a given dollar, he can get more heat by burning corn than by burning coal. If he can, he is, in his peculiar circumstances, economically right to prefer the corn. If he were surrounded by a starving population the matter would be different, but so also would be the relative prices of coal and corn. We are inclined to think that the economical argument by itself is sufficient; but the *American Agriculturist* reinforces it by the consideration that it is the function of corn to promote warmth, and that whether this is done by its action inside the body or outside does not matter much. It is a question which form is most convenient for the man at the time.

WE are indebted to Dr. Bidie of Madras for the following interesting statement concerning the "Rain Tree":—

"Some time towards the end of 1877, I brought to the notice of the Agricultural Society an extract regarding a South American tree called the 'Rain Tree,' which was said to drop water upon and keep moist the ground below. So far as I can recollect, it was resolved to write to Sir J. D. Hooker on the subject, but I see that Mr. Thiselton Dyer has been making enquiries on the subject, and he stated before the February meeting of the Linnean Society, that 'from information from Mr. Spruce it seemed probable that the 'Rain Tree' was the *Pithecolobium saman*, and the so called 'rain' the fluid excreta of cicadas, which feed on the juices of the foliage. The whole phenomenon was comparable to the production of honey-dew from the lime by the agency of aphides.' The cicadas are the 'knife grinder' insects very common in dry forests in Southern India, and so called on account of the shrill grating noise which they make, something like that of some crickets and grasshoppers."

THERE seem to be five different systems of getting rid of the excreta of our towns, struggling for supremacy in the scientific and engineering world at home. There is first of all the dry-earth system, or what is called the Mosaic, which is not likely it seems to make any progress at present. The second is the pail system, and "that is so disgusting as to make it almost difficult to write the word." The third is the earth-closet, which is an improvement, but will not survive. The fourth is the water-closet and water-carriage system, which is the best of the four, according to many but it is the fifth, or Liernur system, that is pronounced to be the best of all.

THE cultivation of opium is likely to become established, it seems, in Eastern Africa. Seeds of the best varieties have been imported from Malwa into Mozambique, where [illegible] acres of uncultivated State land, have been granted to a Company, with a capital of £178,000, for the purpose of cultivating and trading in opium. Besides the grant of land, the Company also receives from the State the right for twelve years, to export opium free of duty. Can any of our readers tell us more about this Company? It is one of the most likely 'speculations' we have heard of, for a long while.

AN enormously rich deposit of argentiferous lead has just been discovered in California Gulch, Colorado. Massive beds of the ore, twenty feet in thickness, have been opened and the proportion of silver is said to reach as high as a thousand ounces to the ton. There may, however, be some tall talk about this find.

WHAT wondrous uses steam is put to now-a-days! We learn from the *Scientific American* that at a recent meeting of the American Fish Culturists' Association, Professor Milner gave an account of the process of hatching shad eggs by machinery, in operation at Havre de Grace, Md., where over eight million shad were hatched last year. The eggs to be hatched are placed in sheet-iron cylinders, with wire-netting bottoms, and half submerged in the river. The cylinders are suspended from the short arms of levers, and given a slow up and down movement by means of shafting carrying eccentrics acting on the long arms of the levers; the whole set in motion by a 10 horse-power steam engine. The engine and other machinery are carried by a large scow, anchored in the stream. The fish so hatched proved hardy, bearing transportation well, even as far as California.

A new mania seems to be imminent. Agricultural journals and others not agricultural, are everywhere agitating the subject of beet-sugar, and deluding themselves and their readers into the belief that a great industry, heretofore neglected, is about to be introduced. Circulars are being spread abroad by public-spirited individuals, pointing out how easily sugar can be made from beet, at every cider mill and cheese factory; if only the beets are grown. It is we believe a great mistake. We can grow the beet fast enough, and too fast, but the manufacture of the roots into sugar is a very intricate, chemical as well as mechanical, operation, requiring great skill and costly machinery. The beet contains abundant salts which interfere with the process of crystallization of the sugar, unless they are got rid of by a careful operation, besides, upon some soils, the beet contains so much of these salts as to render the manufacture into sugar impossible. It would be well for farmers to give a very cautious hearing to those who try to induce them to take stock in beet-sugar factories, and engage in growing beet for manufacture. To grow beet for sugar is quite a different thing from growing for feeding. In the former case only small roots are desired, averaging 2½ to 3 pounds, as these are richer in sugar than the larger ones. Only about 8 tons per acre of these small roots can be grown; the large crops of 30 or 40 tons, so much written about, are not for the sugar business. It is very certain that farmers can make more profit in growing heavy crops of sugar-beet for stock feeding, than light crops for sugar factories, if we had these. It may become a profitable business in time, but it must be remembered that the success of the manufacture in Europe, so much talked of, is the result of nearly a century of costly and persevering effort assisted very liberally by Government aid. It can hardly be supposed, that here where labor is dear and private enterprise must work alone, we can make an immediate success. Pioneers generally fail, and others build upon the ruins of their fortune. Still there are always sanguine individuals who are ready to make experiments, and it is possible that through their failures the way to succeed will be learned. At present, however, it is certain that the risk of loss in the manufacture is greater than the probability of gain. —*American Agriculturist.*

THE details given in Mr. Richardson's new book about the working of the law of division of estates in France are noteworthy. It seems, like most other laws, to be neither an unmixed good nor an unmixed evil. There are nine million landowners. That is a good thing, without question. But then these nine millions have nearly a hundred and fifty million lots of property, —*i. e.* every one has about sixteen, often says our author miles apart. Sometimes the inconvenience produces a remedy. At Estrees St. Denis, for instance the land was so sub-divided that each lot was something less, on an average, than the twelfth part of an acre. The whole was put together, divided into lots of half to three quarters of an acre, and sold by consent of the whole community. The value was in some instances multiplied ten-fold. It is not unfrequent to have the land realloted. Still great inconveniences remain, and the general effect is to diminish production. The average of corn grown is much smaller than in England, and this though the soil is, on the whole, better, the sands not so light, the clays not so unmanageable. Agricultural machines are, of course little used by men who farm on so small a scale. Another interesting fact noticed by Mr. Richardson is that in Maine alone £60,000 are annually realised from the sale of honey.

UNDER instructions from Government, a Committee of officers of which Colonel Cadell, the Inspector-General of Ordnance and Magazines, was president, lately drew up a report on the proposed re-establishment of a Government tannery in the Southern Presidency. There was a Government tannery at Madras at the beginning of the century; and later, in 1821, the Hoonsoor tannery was established by the late Sir M. Cubbon The leather it exhibited at the Madras Exhibition of 1857 was highly spoken of, but the tannery, like its predecessor, had its difficulties to contend with, and a few years later Madras found itself again dependent on England for its leather. Madras has special advantages for an establishment of this sort that the other presidencies have not. Native workmen; farm out a large quantity of leather tanned with an infusion of the bark of the *Cassia Auriculata*, which is easily procurable at Rs. 20 per *candy* of 500lbs. A Government tannery would have a good supply of soft water from the Red Hills. There are as many as eighty-six private tanneries skirting the grounds of Royapooram and Peramboro, and they are all dependent for their supplies of water on wells. These tanneries are largely employed in "finishing" hides and skins sent from the Bengal and Bombay presidencies. Much of the admitted popularity of Madras tanned hides in the Home market lies in the fact that they take dye readily and are very extensively made into what is called "Morocco" leather. The exports in hides and skins from Madras for the official year 1867-77 is given at Rs. 85,18,708. The place selected for the proposed tannery is on the South of the Red Hills Delivery channel at Ayanapurum, and the cost for the necessary buildings, tan pits, &c., amounts to Rs. 21,500.

WILD elephants are rapidly disappearing from British Burmah, and the Government of India has found it necessary to bring in a Bill for their protection. The Karens are the mighty hunters who are exterminating the royal beast, and with true savage unthrift, the more the animals decrease the more they labour to destroy them. It used to be the custom to kill the male elephant only, the females rarely furnishing a tooth large enough for a dagger handle, but the animals are now so few that the hunters think they cannot afford to let even a female escape them. Complete extinction would thus be only a matter of time, and not a long time either. Hence, not too soon, the elephant is to be put under the protection of the law.

THE Batavia *Handelsblad* states that at a meeting of an Agricultural Congress held at Surabaya, on the 21st May, it was determined to offer a reward of 100,000 guilders, for the invention of a process to extract 80 per cent. of juice from sugar cane. On this subject the Batavia *Dagblad* of the 28th May states :—"As to the offering of a high reward to the party who can produce the largest percentage of sugar, it was decided that several sugar manufacturers should engage mutually to offer a reward to whosoever could produce the greatest percentage of sugar; a minimum of 75 per cent. was fixed upon, for which the sum of 50,000 guilders will be made over to the successful experimentor. For each higher number 10,000 guilders will be paid, so that he who makes 85 per cent. of sugar will receive the considerable reward of 150,000 guilders.

MR. G. W. STRETTELL (Burmah) has lately written a pamphlet (copies of which have been forwarded by the Home to the Indian Government) on the utilisation of certain Indian fibres for the manufacture of papers. Mr. Strettell proposes that a consignment of 15 tons of one of the fibres in question should be sent to England for the purpose of experiment by a trading firm.

A CORRESPONDENT of the *East Anglican Daily Times* has some very pertinent remarks on the insufficiency of the Small Birds Act for the real protection of small birds in England. Under date June 4th, he writes to the editor :—

> On the Continent, and in some of our colonies, they are striving to preserve and to increase the number of their birds. We allow country lads, who are profoundly ignorant of the habits, food, and services of the various classes of birds, to destroy the nests and eggs of some of the most useful of the insectivorous migrants and residents. Other countries, for the protection of birds, have passed laws, to exist not on paper merely, but to be enforced rigidly.
>
> We, in spite of opposition, and after much palaver, have got a Small Birds' Act, with this result—the professional bird-catcher snaps his fingers at it, and the rustic amateur knows it not.
>
> What we break down ruthlessly, wiser folks build up carefully. In Austria, Bavaria, France, Germany, Italy, and America, breeding boxes are set up to attract birds. By hand nests are made, copying the form the material, and the workmanship of natural nests. In fact the new trade has risen up and makers compete for the supply of artificial nests to farmers and others. One Viennese maker has a speciality for "little bird's homes:" which are warranted "cat and vermin proof."
>
> Amongst the birds which are thus wooed and housed, may be mentioned the fly-catcher, martin, tits, starling, redstart, wren, wryneck, woodpecker and wagtail. The demand of fashion for the plumage and skins of birds, the snares and lime of the birdcatcher, the brutal destruction of nests and nestlings by boys, and the slaughter committed by short-sighted fruit growers, together make it but a question of time when our English counties shall be as bare of birds as are, now, some departments of our continental neighbours.

FROM practical experiment, it is now being demonstrated that the ginger plant, so extensively cultivated in China, can be successfully and profitably propagated on any of the moist lands of California.

THE largest wheat farmer in the State of California is Dr. Glenn, of Colusi county, north of Sacramento. He farms 20,000 acres. He sold his last year's wheat crop for more than 600,000 dollars, and will receive as much or more this year. His farms are constantly being improved by fencing, the erection of good, permanent buildings, &c., and his stock of farming machinery is extensive and complete.

THE Nagpur model farm suffered a loss last month of upwards of Rs 3,000 by a fire which burnt down the steading with all the seed grain and grain in store for sale. Fortunately, the machinery and implements were saved.

COMMUNICATED AND SELECTED.

GOVERNMENT EXPERIMENTAL FARMS.

REPORT ON THE BHADGAON FARM FOR JUNE.

Superintendent—Mr. A. Stormont.

Weather.

THE heat has continued excessive throughout the month, the temperature gradually reaching as high as 110 degrees in the shade in the second week in June, from which time it again toned down to 100 degrees on the 16th, when the monsoon burst, but with much less violence than was desirable. The shower measured 43 cents., another of 60 cents. followed on the 19th and a substantial one of 1 40 inch the same night, altogether nearly 2½ inches.

Cotton sowing.

2. The quantity of moisture being sufficient for the purpose, cotton sowing was taken in hand yesterday, and is busily occupying the cultivators to-day. Of the farm land about 80 acres have been sown, but the fields having been previously got into good tilth, sowing in the *dry* was quite practicable.

American cotton only being sown.

3. Acclimatized American cotton is being extensively sown this year, in fact no indigenous seed has so far been used in the district.

Grain prices.

4. The few showers of rain have already had the effect of lowering considerably the prices of our local food grains. *Jowari* (the staple article of diet) is now selling at 31lbs. per rupee and pulses low in proportion.

Ploughing match.

5. The ploughing experiment in hand at the date of last report has been brought to a close; the following ploughs were tested under similar conditions :—

1st.—Four iron lever ploughs invented by the late Marquis of Tweeddle.

2nd—A medium-sized Turmorest plough.

3rd—Two newly improved American ploughs.

4th—An "Indian" (combined wood and iron) plough.

5th.—Twenty-two native wooden ploughs, differing from each other, in details of dimension only.

Batch No. 1 could not be got to penetrate the ground at all. No. 2 was similarly useless. No. 3 being wide set and short, did worse work than on a former occasion, when the ground was soft. No. 4 worked fairly well, but would be vastly improved by lengthening the share, when it would nearly approximate to the native ploughs which have once more proved their immense superiority for working in Indian soil.

Mules instead of bullocks, for field work.

6. An experiment has been in hand during the past 15 months to determine to what extent mules might be substituted for bullocks in field work, the latter having suffered so much of late years from disease as to ruin hundreds of cultivators. The Collector obtained for the purpose of the experiment a pair of Spanish pack mules from the Commissariat Department. After proper harness had been got, the animals were trained to all the usual kinds of work with remarkably varied results. Ploughing, harrowing, &c., with them was found to be impracticable. Working as they must do by chain draught, their shoulders rapidly get cut and destroyed from the hard and lumpy nature of the soil and the quick pace at which the animals move as compared with bullocks, which latter also have the advantage of drawing from the *spine* and not the shoulder. In single carts the mules are very useful, and especially so on all kind of work involving circular draught, such as water lifts, crushing machines, chaff cutters, &c. On such work the mules are constantly employed, and thrive on a ration of only 2 lbs. of grain daily, being thus more easily kept up than bullocks.

Bamieh cotton.

7. A sowing of *Bamieh* cotton was made under irrigation ten days ago, the plants are now about a foot high, very strong and from present appearance likely to do well.

Teosinté.

8. The small sowing of the Teosinté (*Reana luxurians*) forage plant mentioned in last month's report as having then been made, came up beautifully, and soon acquired a considerable height; the white-ants however got hold of it, and despite all attempts to get rid of them, they managed to kill every plant. Sowings made now that the rain has commenced will not be exposed to this danger.

Windmill pump.

9. The new Hartford windmill pump has been worked during the past fortnight, with considerable success. The windmill is erected on the bank of a *nullah*, in which the *automatic* pump is submerged at a distance of about 60 feet. The water is discharged over a high bank in another direction.

The whole thing was put up by the farm apprentices and works smoothly and evenly. So much depending on the velocity of the wind, the discharge of water is of course very unequal. With the wind-wheel going 90 revolutions per minute we got a flow of 400 gallons per hour. The machine was working away quietly during the night, when caught by the hurricane which accompanied the burst of the rains, it darted off at a terrific speed, running up to over 200 revolutions per minute, and turning out a very large quantity of water. An hour had elapsed before it could be got securely moored, when it was discovered that the piping had been injured to some extent.

10. The pump is now being removed to Dhulia to be worked on a deep well during the rains.

Report on Nagpur Model Farm for June 1878.

Major J. W. Macdougall, in charge.

Weather.—During the first fortnight the season was extremely trying and intensely hot. After the 15th, indications of the monsoon appeared, clouds began banking up and cool winds set in. For ten days heavy showers of rain could be seen all round about ten miles off, but none fell at Nagpur until the 25th, from which date to close of month the rainfall was most suitable for harvest work, being not to heavy when it came, and coming at such intervals as to permit of work being thoroughly done. Total fall of in for the month 2·67 inches.

in opi.

from the Sta.

Operations.—The planting of turmeric was put out of hand. An acre each of Indian corn, Hinganghat cotton and Carolina rice, and four acres of country vegetables, such as pumpkins, &c., were planted out. Sugarcane was weeded and ridged up. All the fields for the early monsoon crops, such as cotton, thur, and jowar have been cultivated over, and the sowing of cotton, and thur will be finished in a couple of days. A small experimental plot of Bamieh cotton and half an acre of *Reana luxurians* will be out of hand this week.

The soil is turning up very mellow. The seed bed is therefore in first rate condition, but native agriculturists are opposed to fine tilth as a seed bed for early monsoon crops. They prefer a hard pan in spite of their acknowledgements in past years of the deep cultivation practised at the farm, resulting in a greatly increased rate of growth from the first starting of the crop. They have, however, begun imitating our modes of cultivation as far as their light implements and weedy cattle permit.

The farm has suffered a great loss in the destruction by fire, the origin of which had not been ascertained on the 8th ultimo, of the steading, only the machinery shed and office and the machinery and implements having been saved. But all seed grain and grain in store awaiting a favourable market have been destroyed. The total loss was over Rs. 3,000.

The Salaru Farm, Sind.

Superintendent Mr. W. Strachan.

It is yet uncertain what experiments we may be able to make this year. The season began well, and so far as water for irrigation is concerned is still favorable, but the hot wind and locusts have done much damage. Already we have had to resow some four acres of our early sown cotton which was destroyed by locusts about the 2nd of this month. In fact, up to the 12th instant, they continued daily doing more or less damage to the young crops, and I have just heard that on the 15th they visited Salaru again, staying from 8 A. M. to 12 noon, and doing much damage to both the farm and garden plants. Should they continue their visits much longer, it would hardly be possible to get a crop of cotton this year, and more difficult still to make experiments of any value.

Our chief work is at present cotton-sowing, which under favourable circumstances we will not be able to finish before the end of this month.

Cattle of all sorts are very scarce and costly this year. I have heard of many poor cultivators, who have been unable to get the means wherewith to work their land this season. Agricultural seeds of all sorts are very costly, while cattle food is hardly to be got at any price.

After despatching my last monthly report I found I had made a mistake in para. 4. It is there stated that the area sown with tobacco was 20 *goontas*; the correct area is 22 *goontas* or ·55 of an acre.

FODDER-PRODUCING TREES.

THE introduction of fodder-producing trees, as an addition to the available food-supply for man and beast, continues to interest the agricultural powers that be. First in the field was the carob (*Ceratonia siliqua*), of which the flat pods, full of sweet nutritious pulp, are a common article of food along the Mediterranean shores for man, horses, pigs, and cattle. The carob has been recognized as the locust eaten with wild honey by St John in the wilderness. The flour of thi bean forms a considerable proportion of the various cattl foods so largely used in England; and the sweet pod i valued by singers as improving their voice. Many attempts have been made spasmodically to establish the cultivation of the carol here; but only in the Panjab has it obtained any footing. There is however, some hope that the Agricultural Department N.-W. P. will ensure for this useful plant a widely extended trial, whatever the system of arboriculture to be introduced. Of the genus *Prosopis* (another *algaroba*), three species have been tried; the *Prosopi pubescens*, *Prosopis glandulosa* and the *Prosopis pallida*. The firs mentioned is a native of Mexico, and is known as the Screw o Mesquit Bean. The pods are full of saccharine matter and very nutritious, whilst the beans are a most excellent food for horse and mules. Care, however, has to be taken lest the animal drinl too largely after this food, as the seed has been known to germinate within the stomach and to cause death rapidly. Such is no however, the case with cattle; the accident is in all probabilit prevented by the second mastication. The gum also of the *Prosopis pubescens* is a most valuable article of commerce, being almos identical with gum-arabic; it is largely used for medicinal purposes and in the preparation of gum drops, jujubes, &c. Th

Prossopis glandulosa is a kindred plant and a native of Texas. Its uses have not been as yet thoroughly differentiated from those of the *Prosopis pubescens.* The experimental sowings of these two species appear to have been so far successful, but those of the *Prosopis pallida* or *Balsamo carpon* have entirely failed. The pods of the last-named plant are considered to have a high value as a tanning agent. It comes from South America, but has been acclimatized in Ceylon. One species of the *Prosopis*, the *spicegera* is already a native of Upper India, and is known as the *Chaunkora.* It grows in ravines and dry places, and its pods form a favourite food for camels and goats. The *inga dulcis* is a less known tree; but the pods of this also afford an agreeable and nutritious food, and are eagerly collected in the Horticultural Gardens at Lucknow by the starving poor. It is a hardy, quick-growing tree and might be widely introduced into waste lands near villages or even municipalities. That any thing will supplant the universal gram as a food for horses, unless indeed it be the oat, already widely cultivated, one can hardly believe; but any addition to the food-supply and especially of a kind that will not fail in drought, is to be warmly welcomed.—*Pioneer, July* 5.

NITRIFICATION UTILIZED.

ONE of the facts of our modern agriculture, by which it is strikingly distinguished from that of the past, is the artificial enrichment of the soil. Marl and chalk, indeed, have been used in cultivation in Britain since the time of the Roman invasion, if not before it, but it is only within the last forty years that the trade in such manures of natural origin as Peruvian and other guanos, and the manufacture of artificial manures, has grown up. Both the trade and the manufacture have now assumed gigantic proportions. In Scotland alone, it is probable that the sum annually paid by farmers for manures, other than those produced on their farms, considerably exceeds one million sterling. The consumption of such manures within the British islands is estimated at about 7,000,000 per annum. This is supplementary to the ordinary farmyard manure, and to the solid refuse of towns.

The value of the farmyard manure annually produced and used in agriculture, considerably exceeds that of all other manures put together. For Scotland it may be estimated at a million and a half sterling. No manure is more certain in its action than that which is produced on the farm, for it contains all the constituents required for the healthy and luxuriant growth of cultivated plants, though the proportions in which they are present are perhaps not always, the most suitable. When, however, we inquire into the efficiency of farmyard manure, we find it much inferior in this respect to the soluble, nitrates, or ammoniacal-salts which are used as manures It has been ascertained by the laborious and long continued experimental researches of Dr. Lawes, that of the nitrogen which forms the essence of nitrates and ammoniacal salts, about one half is on an average recovered in the increase in the grain crop which results from their application. In the case of farmyard manure, on the other hand, Dr. Lawes found that in the case of 20 successive crops of wheat, the nitrogen recovered in the increase of crop, amounted on an average to one-seventh, and in the case of 20 successive crops of barley, to one-tenth of the quantity contained in the manure applied. The efficiency of the manure in the form of a soluble salt, is thus from three and a half times to five times greater than of that which has to undergo a slow and tedious process of decomposition before it can be available for the growth of plants. It is possible, however, that on other soils the difference in the efficiency of farmyard manure and soluble salts may not be so great, and that on some soils the loss of efficiency in the case of the slowly decomposing farmyard manure may be compensated by other advantages. But it is by no means an excessive estimate to reckon, that if it were possible to bring the nitrogen that exists in farmyard manure in what may be called an insoluble condition into the state of a nitrate, its value would be doubled. This is shown by the fact that if we apply the ratios commonly employed in valuing artificial manure to farmyard manure, we obtain a valuation about double that which is commonly put upon it. This want of efficiency is no doubt partly due to the form in which this species of manure is applied to the soil, *viz.*, that of wet lumps or doughy masses, difficult to subdivide and to incorporate evenly with the soil. If the materials of which farmyard manure is composed were in the form of a dry powder, like slaked lime, there is no doubt they would act much more energetically than in their usual condition, even though they had undergone no chemical change; but their action would be still more energetic if they were brought into a state of complete solubility in water. Let us see, then whether there is not some cheap and simple process by which this can be effected, by which the efficiency, and consequently the value, of farmyard manure may be doubled.

We find this cheap and simple process in what is commonly called nitrification. During the Revolutionary War the French Government, experiencing great difficulty in procuring the nitre required for the manufacture of gunpowder, offered a large prize for a process by which this substance might be made artificially. The prize was gained in 1776 by M. Thouvenel, and since that time nitre has been largely made, by what are called saltpetre plantations or nitre-beds.

These nitre beds are formed by mixing soil containing more or less organic matter and carbonate of lime with stable manure or other refuse, animal matter, and exposing the mixture to the air in long ridges or conical heaps, which are protected from rain, but are watered from time to time with liquid manure and turned over so as to expose fresh portions to the air. Care is taken to keep the mixture sufficiently porous to secure the free admission of the air. After the lapse of a longer and shorter time, the whole of the nitrogen which existed in the organic matters added to the heap is converted into nitrates of potash, soda lime, or magnesia, and that so completely, that Dumas, the distinguished French chemist, is of opinion that the quantity of nitric acid which is formed, is much greater than can be accounted for by the oxidation of the whole of the nitrogen contained in the organic matters present in the mixture. Whether nitrogen is abstracted from the atmosphere during the process of nitrification cannot be considered a settled point, though there are some facts which seem to point in that direction. It is sufficient for our present purpose that the nitrogen is converted into nitric acid without the loss which takes place when farmyard manure is allowed to ferment without any admixture of earth.

The ordinary process of making farmyard manure is attended with great waste. Straw is used as a sponge to absorb liquid matters, an office which it imperfectly performs. When straw is used in this way the difference between its food value and its manure value is sacrificed, and that amounts, if the straw be of ordinary quality, to about £1 per ton. If the farmyard manure be made by animals kept in open yards there is a great waste of fertilizing matter. It has been found by direct experiment that in such circumstances, after a lapse of twelve months at least, two-thirds of the substance of the manure is wasted, and only one-third inferior in quality to the original substance is left behind. From this it follows that with this method the ordinary loss of fertilizing matter does not fall very much short of one-half. This loss arises mainly from the washing out of the valuable matter by rain. A less considerable waste arises from the escape of ammonical gas. These losses would be completely prevented by subjecting the manure to the process of nitrification. The use of straw as an absorbent would be minimized, dry earth being substituted for it. This earth kept under cover, would completely retain all the fertilizing ingredients of the animal refuse mixed with it, and would, if properly treated, bring all the nitrogenous matter into a soluble form, in which, as a manure, it would produce its maximum effect. It may be objected that the mixture with a mass of earth would increase the labour of distribution, but this would be compensated by the effect of the process upon the earth itself. Good earth often contains a quantity of nitrogenous matter, little inferior to that which is found in farmyard manure, but it is in a state in which it is still more dormant and unavailable for plants. By the process of nitrification this dormant nitrogenous matter may be transformed into nitrates, and thus brought into a state of great activity. The unfavourable mechanical condition of farmyard manure will also be removed and replaced by a condition eminently fitted for even distribution. In this way the quantity of effective nitrogenous manure at the command of the farmer will be greatly increased, and he will be rendered independent of external supplies of nitrates and ammoniacal manures.

A. L.

THE "MODEL FARM" AT SYDAPETT.

IT is surprising so few Madras folk ever think of paying a visit to the Sydapett Farm, or the "Government Model Farm" as it is more correctly styled. It would be, indeed, a couple of hours well spent, of a fine morning to walk over the grounds of the Farm and inspect the various processes of cultivation, and the improved appliances at work under the able direction of Mr. Robertson and his assistants. The College and Lecture-room are also worth a visit, containing as they do a museum on a small scale, choice library of scientific works, and a collection of fossils and various kinds of earth, with coloured maps and engravings serving to illustrate the subjects of botany, chemistry and animal, and vegetable physiology, which, together with practical agriculture, are the chief subjects taught in the College. The lectures are delivered by different Professors engaged for the purpose in regular routine, and the frequent examinations instituted by the Principal must, of necessity keep students well up in their studies. If there is any deficiency at all it can only be in the departments of practical agriculture, to which perhaps not so much time has been devoted as some of the students might wish, but which we understand is to employ a larger share of attention at the opening of the next session under the able teaching of Mr K. Shiffinaver, Professor of Agricultural Chemistry. The College, as it stands, is quite a *multum in parvo,* containing much in a small compass, but sufficient to meet the wants of the students, and adequate to the requirements of the farm as at present constituted. The new house for the Principal, which was completed last April, is a handsome building of red brick, standing to the west of the College, and presenting an attractive appearance as seen from the main road. Its front entrance faces the river, of which it commands a full view as well as of the Marmalong bridge, St Thomas's Mount and the more distant Palaveram hills. There is another building under construction nearer the road, which is intended as a laboratory for the College, the chemical and other apparatus for which have, as we are informed, already been ordered out from England. The site has also been marked out for the erection of a new college as soon as the funds are sanctioned, which college is to be a *pucka* building of ample dimension and the plan of which may be hanging on the walls of the building now in use. The college is now enjoying a recess, and most of the Parsee students have gone to Bombay to see their friends. The Principal has proceeded to Ootacamund where no doubt, he will perfect the plans he intends to lay before Government for establishing model farms in other parts of the Presidency, especially in the Coimbatore district, which has long been talked of. The favor that such a proposition will meet with in the eyes of the Indian Government, must depend of course entirely on the proved success of the experiment already initiated at Sydapett, and this, as far as we can judge, certainly does not belie expectation.—*Madras Times.*

AGRICULTURE IN INDIA.

[By F. C. Danvers Esq.]

ONE of the most important questions of the day with regard to the administration of India is, undoubtedly, that of the proper means to be adopted to meet the necessities of the populations in seasons of famine, which are ever recurring in different parts of the Empire, and apparently increasing in intensity and in the extent of their influences. The causes of these famines have engaged the serious consideration of many learned men and scientific societies, and not long since there appears to have been a general concensus of opinion that they were in some way or another attributable to, or at any rate coincident with, certain solar phenomena, which exerted their powers for evil at periods of maximum sun-spots. Whether or not there is any connection between the two, appears, however, upon closer investigation, to admit of considerable doubt; but if the sun-spot theory has any basis or foundation, it seems quite clear that human agency must be unavailing to contend with influences operating from a distance so far beyond its reach, and all that can consequently be done will be to provide the means to counteract those influences, so far as may be possible. Valuable as these investigations undoubtedly are from a scientific point of view, it is more desirable that practical men should turn their attention to the discovery of some remedy for famines, rather than to speculations as to their remote and unassailable causes, lest by directing so much attention to extra-terrestrial things, men's mind be diverted into spheres of visionary flight, and away from a consideration of those influences wrought by human agency upon the earth, through alterations in the normal conditions of its surface. This, too, is done without due appreciation of the disturbance thereby created in the equilibrium of natural forces which undoubtedly constitute the evils, whose results are felt during famines, and which it should be the principal aim of science to amend or counteract.

Various remedies have been from time to time proposed [illegible] view of counteracting the effects of drought in tropical climate [illegible] two most generally advocated being irrigation and improved means of communication.

No doubt both of these are most important, as the former [illegible] of w [illegible] where practicable, provides the means of conveying the [illegible] the soil which the rainfall is usually expected to provide, and so renders cultivation possible where otherwise it could not be undertaken at all; whilst the latter provides the best means for conveying food to famine-stricken districts from seaports, or inland regions, where the necessary supplies may be available for the purpose.

Amongst the various reasons that have been assigned for the occurrence of famines in seasons of drought in India, not the least important appears to be the defective state of agriculture practised by the native cultivators. Although the primary cause in each case of serious famine in India has been either the total failure of the usual rains, their deficiency in quantity, or the inequality of their distribution over the usual seasons of agricultural operations, there seem to be good grounds for believing that, even under the worst conditions of deficient rainfall, the effects of drought upon the soil might be considerably mitigated by a due observance of those laws which are now tolerably well understood in this country, but, either on account of the poverty, or want of energy, of native agriculturists, are more or less neglected in India. Whilst a neglect of the known laws of agriculture would be attended by comparatively unimportant results in this country, where so small a proportion of the population is dependent upon the produce of the land for a living, and by far the greatest part of vegetable and animal food consumed is imported from abroad, the case is quite different in a country like India, which is dependent upon its own internal resources for food supplies, and where considerably more than half the population live by agriculture.

The increasing population of India is constantly necessitating fresh lands being brought under cultivation, in order to meet the ever-growing demands for food; and at the same time the remark appears pretty general that the land is not so productive as it used to be. This, no doubt has arisen from two causes in the first place, the land that is now being added to the cultivated area is of an inferior quality, and, under the existing rude state of cultivation the produce which it yields is often barely sufficient to do more than cover the cost incurred; and, secondly, the exhausting nature of the tillage is gradually lessening the productive powers of the, better soils. The state of the country generally appears to be very similar to that of Rome in the first century of the present era, when L. Junius M. Columella, in a letter to Publius Silvinus, stated :—

"The magnates of the State are in the habit of complaining of the sterility of the land, or of the unsettled state of the weather, which has now for a long time exerted an unfavourable influence on the growth of agricultural produce; others are of opinion that the soil has been exhausted by the over-productiveness of former years. But," he continued, "no one gifted with common sense will ever permit himself to be persuaded that our earth has grown old as man grows old. The sterility of our fields is to be imputed to our own doings."

This state of things has, however, not been confined to Rome, for the same results have been observed in modern times in the United States, Mr. H. C. Carey, of Philadelphia, in letters to the President on the foreign and domestic policy of the Union, and the effects as exhibited in the condition, of the people and the State, observes, with reference to the practice of annually exhausting the plant-food from the fields by constant cropping without making any corresponding compensation to them in the shape of manure :—

"That the consequences of this may be seen in the fact that the soil is almost everywhere exhausted, and that the prosperity of the country is declining instead of increasing. In New York, where the average yield of wheat was from 25 to 30 bushels eighty years ago, it is now only 12 bushels. In Virginia and Kentucky tobacco was grown until the soil was completely exhausted, and had to be abandoned; and in the cotton districts we met with a state of exhaustion unexampled in the world for the shortness of the time in which it has been brought about."

Evidences of a similar state of things exist with regard to certain parts of India. Mr Harman, of the Bangalore Government Farm, remarks on the deterioration of the soil in Mysore owing to the defective agriculture, as shown by a gradual decrease in the outturn during seven years. In 1868 the average outturn per acre was, of paddy, 1,577lbs.; of wheat, 758lbs., and of cotton, 676lbs; in 1874 these quantities were reduced to, paddy, 1,011lbs.; wheat, 628lbs.; and cotton, 281½lbs. Both of these years, is should be stated were favoured by good seasons. In the Settlement Report of the Hoshungabad district it is stated that the old rate of produce in the Nurbudda Valley, fifty years ago, is supposed to have been [illegible]-fold, but that it is now estimated at only six-fold. Dr. Liebig, in his letters on Modern Agriculture, pp. 176-77, remarks —

"There are fields that will yield without manuring for 6, 12, 50, or 100 years successively, crops of cereals, potatoes, vetches, clover, or any other plants, and [illegible] whole produce can be carried away from the land; but the inevitable result is at last the same; the soil loses its fertility, the fields will ultimately be brought [illegible] state of exhaustion, the corn will only yield an amount equal to the original seed, the potatoes will no longer produce tubers, and the vetches or clover will die away, after barely appearing above the ground."

This appears [illegible] be the state of things to which a great part of India is gradually but surely [illegible] owing to the defective system of cultivation generally practised by the ryots. In the Settlement Report of the Chanda district we read —

"When re [illegible] is taken up for rice cultivation, the ground can never be got into proper order during the first year, and the yield is less than in the old fields. In the second year the return rises about an eighth above that of the old fields, and increases gradually year by year, until the fifth, when it reaches 50 per cent. above the yield of the old fields; it then commences to decline, and in about another five years, has subsided to the level of the old field [illegible] land-growing dry crops seems also to reach its highest point of fertility in the fifth year of cultivation, but it falls more slowly to the old fields, than is the case with rice lands, and a field twenty years old will be more productive than one which has been fifty years under the plough. When a cultivator sees a field becoming sterile, he allows it to be fallow for from two to five years, in the meanwhile pasturing his cattle thereon, and when the land is again sown, it is found to give a yield equal to its neighbours."

The question as to what measures should be adopted to counteract these evils, is one which affects the State as well as the people themselves. The land being the principal source of revenue to the State, the more produce it can be made to yield the more easily will the land tax be paid by the people. If the land is only half-tilled, and starved as regards manure, the State's share of the produce will appear large, but let the land be properly tilled, and that share will at once bear but a small proportion to the whole produce. As long as only moderately good soils are tilled, a rude system of husbandry may suffice to meet the wants of cultivators, but now that the inferior soils are being taken up for culture, it is necessary that an improved method of agriculture should be adopted. With the exception of irrigated lands, but little manure is generally employed in India, the principal food crops being, as a rule, neither manured, nor irrigated. The cultivators are fully aware of the advantages resulting from the use of manure, but as yet they consider that the additional labour and cost involved are not sufficiently compensated by the increased yield. Much of what ought to be given to fields as manure is now used as fuel, and during the late famine in Southern India some quantities of cattle dung were exported from the district of Trichinopoly to Ceylon, where it fetched a very high price.

With regard to the value of manure in increasing the yield of crops, experiments made by Messrs. Lawes and Gilbert, at Rothamsted, on wheat and barley grown for many successive years on the same ground, may be quoted. The soil experimented on was a rather heavy loam, with a subsoil of raw, yellowish red clay, underlaid with chalk, which provides good natural drainage. The table on the following page shows the difference in the yield on manured and unmanured land, and the figures show a gradual tendency towards exhaustion of the unmanured land, whilst the yield of the manured land, was not more than double than that of the unmanured land, and its amount had a tendency to increase instead of diminishing, but the weight of grain per bushel was higher from the manured, than from the unmanured land.

	Bushels per acre.				Weight of Bushels per lb.			
	1852-62 yearly average.	1863-72 yearly average.	1873.	1874.	1852-62 yearly average.	1863-72 yearly average.	1873.	1874.
Unmanured land ..	15·2	13·3	11·8	11·5	58 9	59 3	57 0	
Land receiving yearly 14 tons of farm-yard manure per acre ..	34·5	36·0	26 8	30 25	59·0	61·0	57 1	60 25

The average produce per acre on a series of observations extending over ten years, in several districts of the Bombay Presidency, was found to be as follows :—

	Bushels.	Pounds.
Wheat	9	... 585
Jowari	10	.. 650
Bajri	6	.. 390

So that it appears that, whilst wheat on properly cultivated but unmanured land in England produced a yield of 655lbs. per acre, in Bombay it yields only 585lbs., or nearly 11 per cent. loss, which difference may possibly be due to inferior cultivation or greater exhaustion of the soil on which the crops were grown, or in a measure, to both of these causes combined. In the Dehra Dun, the produce from wheat cultivation averages 1,260lbs per acre, and at the Sind Experimental Farm, bajri has yielded as much as [illegible] per acre. Agricultural statistics of this sort are, however, very [illegible] in India; and it would, perhaps, be hardly fair to take the yield obtained from small areas at Government experimental farms as a [illegible] of what might be realised generally by improved cultivation. What evidence there is on this point, however, shows conclusively that by proper tillage, the land may be made to yield a better increase than at present, and it has been remarked that, by careful cultivation, the inferior lands, paying a low rate of assessment, do often yield more than the better and more assessed lands when badly farmed. There is, indeed, no apparent reason why the soil of India should not under favourable circumstances of agriculture yield as much per acre as the soil [illegible] England [illegible].

The value of manure to the soil is not always [illegible] to the supply of plant food. In the case of mineral manures this is no doubt the principal benefit conferred, but with manures containing [illegible] different. From experiments made at [illegible] with soils in their natural condition, and when [illegible] of organic and 20 per cent. of mineral manure it appears that [illegible] dung or of any other substance, have little or no effect in increasing the moisture condensing powers of a soil, whilst the addition of 25 per cent. of organic matter increased its condensing powers nearly 300 per cent., and to a less degree by the addition of organic manures in smaller proportions. Further experiments showed that, in soils to which 5 per cent. of organic matter had been added, water ascended from below much more slowly upwards than in the natural soil, and that they hold much more water than the unmanured soils, their powers to raise up moisture being increased 10 per cent. As a general rule, native farming exhausts the organic matter in the soil, and thus renders it less able to take up moisture from the air, and consequently less able to withstand the effects of a drought. From the foregoing, it appears that not only is organic manure beneficial for increasing the productiveness of a soil by supplying plant food, but it is also calculated to benefit the crops in dry seasons, owing to the effect it has upon the soil of increasing its powers of absorbing moisture from the atmosphere and of resisting the powers of evaporation. Salt is also a valuable agent in bringing about the same results, for in the first place, it prevents the too rapid decomposition of organic matter in the soil, and, by the well-known affinity all alkalies have for moisture, it also increases the power of the soil to absorb it from the air.

It is to be feared that, owing to the rapid clearing of the jungles in many parts of India, and the consequent increasing scarcity of firewood, cattle dung is becoming even more extensively used than formerly for fuel, and the land is thus deprived of its natural manure. Under these circumstances the only alternative appears to be the use of green manure, or of allowing the land to lie fallow periodically. The practice of fallowing, or resting the land is a practical protest against the waste of continuous clean culture; the growth of grass and weeds, it shades and protects the surface, appropriates the ammonia of the atmosphere when ploughed under for a crop, and restores to the soil its supply of vegetable matter, wasted under the direct rays of a burning sun. The following advantages of green manuring are instanced in the report of the Department of Agriculture at Washington for 1874 :—

1. Economy in transportation and in the application of manures.
2. The rapidity of their decomposition.
3. The saving of all the constituents of the manure.
4. The elevation of the temperature of the soil in the process of decomposition.
5. The protection of the soil from the effect of solar heat, preventing the evaporation of moisture, and retaining in the soil the fertilising gases derived from the atmosphere, which decompose the vegetable matter in and upon the soil.
6. The pulverisation of the soil, making it loose and friable, by the chemical changes at work in the process of the fermentation of vegetable matter.

This last is by no means the least [illegible]
will hold more water than those, whose [illegible] are encouraged, by bounties
the greater number of their capillary tubes. [illegible] past to excite thought an
Want of manure is however not the only [illegible] [illegible]boriculture. A law of the
unproductiveness of the soil in India, as in many parts [illegible] encouragement of timber
to the presence of salts in undue proportions. It h[illegible]ments in this direction.
Robertson, the Superintendent of the Sydapet [illegible] India, where, with some
soil which contains more than a half per cent. [illegible] California, there would,
washed out by water cannot possibly be producti[illegible] extending the areas of plan-
rich in the elements of plant food, and that an [illegible]onr, thus securing to agri-
of one that may possess considerable value as a [illegible] of trees, amongst which
barrenness instead of fertility. From an agri[illegible]oved by past experience—
Kattywar by Mr. E. C. Schrottky, in which [illegible]; protection of crops from
soils was made, it appears that certain fields [illegible] the decaying vege[illegible]
to pay for labour and taxes, contained quanti[illegible]ed available for [illegible] sodium,
diminishing from the surface downwards, in the [illegible]tance, addition[illegible]on :—

	Per cent.
First 6 inches of surface soil	3·00
Soil 1 foot below surface	0·18
Subsoil 2½ feet	0·14

He considers it evident that this salt, which must have been at one time equally [illegible], has been drawn up to the surface by evaporation and capillary attraction. The remedy suggested for this is subsoil drainage by means of which the salt may be [illegible] through the upper strata to the lower, instead of the [illegible] now takes place.

A[illegible] barren soil of its excess of salt [illegible] that the benefits of subsoil drainage [illegible]. On this point we are not [illegible] considerable economic [illegible] Ma[illegible]. The experiments there [illegible] a profit of Rs. 12 to a stone-drained plot, and of nearly R[illegible] in a pipe-drained plot. Referring to these experiments [illegible] :—

"[illegible] are the results, they do not fairly exhibit the benefits in the instance [illegible] by subsoil drainage, for it must be remembered that, before draining, the land was hopelessly unproductive, having been rendered so by swamp cultivation."

and, he adds :—

> "Throughout the long drought which we experienced during the year, [illegible] plant on [illegible] land was always green and fresh, while [illegible] on undrained land was withered and blighted."

Th[illegible] land is not drained, heat or c[illegible] affect the soil deeper than about a foot; but if there be drains [illegible] becomes more porous, and permits a greater movement [illegible] the [illegible], more or less, the soil between the surface and the drains, a depth of three or four feet. Thus what the heat gains in space it loses in intensity; and the surface soil being, therefore, less heated and baked, loses less moisture by evaporation.

This principle is dwelt upon by Professor Liebig, who states that when in a hot summer the surface of the ground is dried, the powerful attraction of the soil for the vapours of water in the air provides the means of supporting vegetation. A second source from which the dry soil derives by absorption its moisture, is presented by the deeper lying moist strata, from which a constant distillation of water is taking place towards the surface. By drainage, the water, which rises by capillary attraction, being placed at a greater depth, the dry soil now derives from the lower strata a quantity of moisture in the form of vapour, which supplies the wants of plants. Hence it appears that subsoil drainage, renders the land less liable to be seriously affected by draught, and so far it is calculated under certain conditions to mitigate the effects which, in India, now invariably follow upon a failure of the usual rains, or even their unequal distribution during the monsoon seasons. A similar application of drainage to pasture lands would also, doubtless, tend much to improve the quality of the food* for cattle in India, as it has also done in this country, by preventing the herbage from so rapidly drying up, as it does now, during the hot seasons, and by improving the quality of the pasture itself.

One of the great defects in the present system of agriculture in India, has been attributed—and apparently with some reason—to the inefficient manner in which the farm-cattle are fed. As a general rule, the cows are half-starved, and consequently, but little milk is obtained. The cows and calves, according to the account given in the Hoshungabad Settlement Report got nothing at all except what they can pick up; but sometimes a little food is given them at night for the three months before the rains begin. The bullocks are stall-fed for about three and a half months, from April to the middle of July; thence to the end of October they live on the grass they find, and after that, to the end of January, that resource has to be supplemented by a gradually increasing the quantity of hay, and during February and March, the live on the green teora, wheat stubble, and the thrashing floor. A cultivator, with 25 acres of arable land to each plough, requires eight acres of pasture to support his cattle; but besides the fallows, there exists, in some districts in the hill pasturages, a resource which is largely utilised, and no doubt might be often more extensively made use than it now is.

* In India grasses for food for cattle do not appear to be ever cultivated. The ryot never manures his pasture land, and he crops it incessantly with cattle, sheep, and goats, as long as these animals can obtain a scanty support on it. The only time when the pasture land is allowed rest is

T

grass which then springs up, is con-
for establishing model farms in other parts The grasses are thus never permitted to
in the Coimbatore district, which has lo limited extent, and hence much of the
such a proposition will meet with in these circumstances, it can be no cause of
must depend of course entirely on small and poor; and there is an opinion, in some
already initiated at Sydapett, and inferior to what they were some years back.
does not belie expectation.—*Madras*, cattle being difficient in strength, are unable to
admit of the ground being properly cultivated.

AGRICULTU is everywhere only shallow-ploughed, and the

rs the soil but does not turn it over. Mr. Robert-
[By F. C. Le Coimbatore District, remarked upon the defec-

ONE of the most important quest one or two places he saw some good cultivation
administration of India is, undou digging the ground over with crow bars, by
be adop means of the necessities of then stirred to a depth of fully 12 inches.
whic Blocks of gg in different weight from 10lbs. to 12lbs. are, by this
means, raised ed in over during the dry weather; after a heavy
shower of rain these fall to pieces and a fine tilth is produced. The
effects of this crow-bar cultivation are supposed to last over 10 to
12 years. This system of tillage is however, slow, tedious, and expen-
sive, but the same results might be obtained by the use of improved
ploughs and agriculture implements at a less cost—after the first outlay—
than is now incurred for the miserable system in general use. The native
plough, of which specimens are shown in this room, is very much the same over the greater part of India. It varies in weight from about 40lbs. to 80lbs. or even 100lbs. The iron share weighs from 1lb. to 6lbs. In ploughing, the ground is scratched over several times—sometimes as often as five or six times,—after which comes the sowing. The preliminary ploughings disturb the surface, but do not turn the soil over, to a depth of about four inches, and the drill plough goes about three inches deeper. The upper four inches of soil are well dried in the process of ploughing, but the drill plough lets the seed down into a lower and moist stratum.

The illustrations exhibted on the wall which have been kindly furnished by Messrs Ransomes, Sims, and Head, of Ipswich for the purpose of the present paper, represent five classes of ploughs suitable for Indian agriculture, most of which are actually at work in that country.

No. 1 represents an adaptation of an Egyptian plough, which turns a furrow 8 inches wide by 5 inches deep. It weighs 89 lbs. The small breast attached to the plough is intended for breaking up land, whilst the large one, which is shown detached in the drawing, is intended to be used when the land is well cultivated and broken up.

No. 2 represents a small wooden plough, for turning a furrow about 7 inches deep and 10 inches wide. Its weight is 51 lbs. This is thoroughly adapted for ploughing in all wheat-growing districts, and can be used with a couple of strong oxen on medium and light soils.

No 3 represents a light plough, made entirely of iron and steel, capable of turning a furrow 4 inches deep and 8 inches wide, with a pair of small bullocks. This plough is called a "turn-wrest plough," that is to say, the breast is made double, so that when the ploughman arrives at the end of the furrow, and has thrown the soil on the right hand side, he changes the position of the breast, so that the plough will throw the soil on the left hand side of the breast when returning. It weighs 63lbs

No. 4 is a common subsoil plough, as used in Bohemia, and some parts of Austria. This subsoiler is intended to follow an ordinary plough, and will pulverise the soil to a depth of about 12 to 13 inches. Its weight is about 105 lbs.

Nos. 5 and 6 show an improved subsoiler, which can be used as a double furrow plough, or as a combined plough and subsoiler, as shown in the drawing, by simply removing the front breast, and substituting an iron prong, which stirs up the lower soil. This plough enables the land to be stirred up to a depth of from 12 to 14 inches and consequently the roots are able to penetrate into a much damper soil than when the land is only ploughed 6 or 7 inches. It is, however, heavy, and weighs 4 cwts. 1 qr.

The benefits to be derived from stirring up the subsoil will be appreciated wherever the upper soil has become considerably impoverished by continued over-cropping.

The results of experiments made on the Wisconsin University Farm,
during the years 1871-74, in testing the effects of different depths of plough-
a ing on nearly level clay land, having a stiff clay subsoil, may, perhaps, not
the inappropriately be referred to. It was shown by these experiments that deep
The ploughing was the more advantageous in very dry seasons; but in other
being b years shallow ploughing was preferred, owing to the want of drainage, and of
demands fo t for the superfluous water which flowed on the retentive soil. These
general that t were remedied in the fall of 1873, by laying an underground drain
has arisen from each of the plots.
added to the cultiva wing table includes the results obtained in 1871, which was a
rude state of cultivation e yield is given in bushels of 75 lbs. each :—
ent to do more than cove.
nature of the tillage is grad
better soils. The state of the
to that of Rome in the first cen
M. Columella, in a letter to Publius
"The magnates of the State are in t
of the land, or of the unsettled state of th
time exerted an unfavourable influence on th
others are of opinion that the soil has been ex
tiveness of former years. But," he contin
common sense will ever permit himself to be persua
grown old as man grows old. The sterility of our fiel
our own doings."

ltivation.	1871.	1872.	1873.	1874.
	bushels.	bushels.	bushels.	bushels.
..	55·4	47·5	53·4	53·0
..	50·6	50·3	52·9	58·1
	44·9	54·7	53·1	53·3
	52·2	56·3	51·1	60·8

In a report by Dr. Lynch, of trials made with English and American ploughs, at the Presidency Jail Garden, at Calcutta, it is stated that both English and American ploughs were easily worked by a pair of ordinary bullocks. As regards the quality of the work, it was found that a native ploughman, using the English plough, was capable of turning up the soil to a depth of six inches, more rapidly than he could turn over the same extent of ground to a depth of three inches with a native plough. Apart from the advantage of mere ploughing, however, the English plough was found to possess other powers, such as hoeing, ridging, and furrowing, all of which could be done far more cheaply and rapidly therewith than by native implements.

At the Model Farm, at Allahabad, the English plough, worked by buffaloes, was held to produce far better ground in less time than the native ploughs; whilst Mr. Lloyd, the superintendent of the Amritsar Farm, has stated that the outturn from land worked with the English plough is certainly not less than 15 or 20 per cent. more than that worked entirely on the native system.

Deep ploughing, by opening up the soil, will, as has been already explained, enable the land to retain moisture longer than when cultivated under the native system. In some cases of barrenness, it may be shown that deep ploughing alone is necessary to restore the soil again to fertility; for, as is pointed out in a recent report on the Sydapet Farm, if the surface soil to a depth of three or four inches, contains say, one per cent. of soluble salts, that would, of course, render the soil unproductive if only tilled to that depth; but if analysis proved that the strata immediately beneath contained say, only ¼ per cent. of soluble salts, it is easy to see that to improve the surface soil it would only be necessary to plough deeply into the lower soil, and mix it with the upper layer. But, whilst dilating upon the advantages generally derived from deep ploughing, it must be borne in mind that occasionally the results are otherwise than beneficial. Dr. Voelcker has published an account of a case in Holland in which, after deep ploughing, the land refused to grow anything, even weeds. The work was undertaken by an English gentleman near Haarlem, and the result was discouraging and disastrous owing, to the presence of protosalts of sulphur, sulphites and sulphides, in the deeper layers of the soil. These poisoned the surface soil, and required years before they became sufficiently oxidised to be harmless or beneficial. Mr. John Wrighton, of the Agricultural College, Cirencester, in a letter to myself on this subject, remarks as follows :—

"1. The bringing up to the surface of partially decomposed (sour) substances of acid reaction would always be injurious, and could only be done successfully, if at all, by gradual deepening of the soil undertaken during successive seasons.

"2. Deep ploughing should not be attempted where the subsoil is of inferior quality. In this neighbourhood, when the upper chalk is close to the surface, we never allow the white crust to be ploughed up. It would swamp the thin layer of good soil on the surface, and if done rashly would spoil the field.

"3. It was generally thought that much mischief was done on some of the fields on the Royal Agricultural College at Cirencester (great oolite formation) by too deep ploughing.

"4. To rashly plough up clay lands much deeper than previously, would also introduce an intractable element. Such newly brought up matter would not pulverise for a long time, and would do harm. It was the late Mr. W. Smith's (of Deanstown) idea, to first shiver and break such soils with the subsoil plough, without bringing the material to the surface, and afterwards to deep plough, when air and water had acted upon the subsoil. Also good farmers of clay land will gradually deepen these soils by ploughing just a little deeper before taking roots, that is about every four years. The deeper furrow is given in the autumn so as to receive the benefit of the frosts in winter.

"5. Deep ploughing is not usually thought advisable for corn in this country. The late Mr. Smith, of Lois Weedon, certainly dug deeply for wheat, but this extra depth was obtained by going a little deeper every year. On clay lands a fairly deep furrow for wheat is given consistently with paragraph 4 of this letter, but barely is generally thought to prefer a shadow furrow and a fine surface.

"6. Ploughing for 'roots,' *i.e.*, mangel, swedes, carrots, turnips, &c., is the opportunity for giving a deep furrow, usually taken by good farmers in England, and even then care is taken to bring only a small amount of fresh soil to the surface.

"7. Deep ploughing is sometimes advisable, as upon deep alluvial soils, where the texture and quality of the soil is uniform to a considerable depth. But even here the case first cited should be borne in mind. From all I hear and read, there is no doubt better and deeper cultivation might be introduced successfully in India."

It is impossible to omit, in this paper, some reference to the subject of irrigation which has been so strongly advocated as a panacea for famines. All water is, however, not equally beneficial for the purposes of irrigation. When carbonic acid gas is carried into the soil by irrigation water, it acts upon and sets free large quantities of previously inert plant food, and in this way contributes to the production of a good crop, but Mr. Robertson, in a recent report, has observed that there is wide difference between the action of an irrigation water containing potash, and that of one containing only carbonic acid; the former supplies directly the material which aids in the production of the crop, the latter merely stimulates into activity the plant food previously in the soil; hence, a piece of land irrigated by the former water may be maintained in a fertile state for years, while land, irrigated by the latter, becomes gradually poorer as each successive crop is removed.

The quantity of water really required, or that is most beneficial to a crop, is a question that does not appear to have been sufficiently considered, but experiments in this direction have been made at the Lucknow Horticultural Garden. Here four beegas of land were each divided into four equal parts, each for a crop of wheat, gram, barley, and peas. One-fourth beegah was irrigated every seventh day, one-fourth, every fourteenth, one-fourth every twenty-eight-day, and one-fourth was unirrigated. The difference in irrigation did not appear to affect the quality of the grain, but the quantity of the produce was affected in a very marked manner. The most satisfactory produce was that by one irrigation every twenty-eight days. In all cases the amount of grain by irrigation once in twenty-eight days was nearly double, or more than double that by irrigation once every week. The amount of straw in the case of wheat and gram was also increased by diminishing the number of irrigations, but not to such a marked extent as the grain. In certain observations made in the Godavary District, in 1872, it was noticed that for rice cultivation the ryot took water to the aggregate extent of 9 feet deep, in addition to a rainfall of 26 inches to bring to maturity one acre of paddy. The quantity used in other irrigation experiments varied from 6 to 7 feet in depth in addition to the rainfall. Mr. Robertson, of Madras Farm, however asserts that under moderately good cultivation, with a soil of fair average quality, a volume of water about 4 foot in depth would be ample for the production of a paddy crop; "not only," he observes, "does swamp irrigation cause an enormous waste of a valuable producing power, but it is highly prejudicial in many other ways; the health of the people is injured; the soil is rendered unfit for cultivation, except under semi-aquatic crops of low types, and the capabilities of our irrigation works are lessened by the smaller area thus watered." These are most important facts, effecting not only the value of irrigation to the cultivator, but it necessarily follows, that if irrigation water is used so largely in excess of what is necessary, a more judicious distribution of it would enable existing irrigation works to command considerably increased areas of cultivation, and the question as to the remunerativeness of that class of works would be at once set at rest.

The last question, which it is proposed briefly to consider, in the present paper, is the influence of trees as affecting climate and cultivation. It is a well-known fact, that the wholesale destruction of trees is not conducive to the improvement of the agricultural prospects of any country but quite the contrary; and the injurious effects of destroying the balance of nature between tree covered and open lands have been too repeatedly experienced to admit of any question. In a letter addressed to Sir Joseph Hooker, by the Superintendent of Gardens in Jamaica, of the 5th November last, it is stated that, in certain localities hundreds or thousands, of acres have been converted into desert by the wholesale destruction of forests, and that in other localities hundreds of thousands of acres would from the same cause, now be utterly unproductive but for the interposition of foreign trees. Mr. Buck, Director of Agriculture in the North-Western Provinces, has observed :—

"It may be admitted as an axiom that trees are a powerful engine in the production of coolness and moisture, and that their growth throughout a country afflicted with dryness and heat should be promoted. The protection of mountain forests is all very well as far as it goes, but a much greater, because a more proximate influence will be exercised by the increase and encouragement of scattered groves, of lines of trees, and of small plantations throughout the agricultural area of the provinces, in which direction little has yet been done.

This subject was considered in a recent number of the 'Indian Agriculturist," wherein it was stated that,—

"The beneficial influence of plantations as shelter to farm lands and crops, is apparent and indisputable. Without shelter good crops will not be attained at high elevations, even on moderate soils; and it has been known in cases where land without shelter was not worth cultivation, when portions of it were planted, the remainder became good pasture, and yielded a fair return on the cost of labour in cropping it."

The Indian Government is undertaking a work of gigantic magnitude in the conservation of forests throughout the Empire, and the establishment of firewood reserves; but it would evidently be impossible for any staff of officers that could reasonably be employed by Government to undertake or supervise such planting throughout the country as is required in the interests of agriculture generally. A similar want of trees about cultivated lands to that now experienced in India, has been felt in different parts of the American Continent, and measures have been from time to time adopted with a view to its correction. By a law of Califorina, dated the 30th March, 1868, the Board of Supervisors in each country are empowered to authorise owners of lands to plant and cultivate, along the public highways, shade and fruit trees, specifying the species to be planted, at what age, at what distance from each other, and from the road bed, and making the necessary rules for their protection. &c. Four years after the planting, upon receiving a duly certified statement of the number then in a good condition, the Board are directed to pay to the cultivator one dollar for each such tree. The States of Illinois, Missouri, and Iowa have also encouraged tree-planting by State Laws. Massachusetts, in 1858, offered a premium of 1,000 dollars for the best plantation of forest trees planted in 1860, payable in 1870. It was won by Major B. P. Poore. States, societies, and individuals have encouraged, by bounties the planting of trees, with sufficient success at least to excite thought and stimulate effort upon the subject of practical arboriculture. A law of the United States has also recently been enacted for the encouragement of timber growing. What has been done by other Governments in this direction, might, no doubt, be advantageously followed in India, where, with some such direct pecuniary encouragement as is given in California, there would, it might be anticipated, be no difficulty in vastly extending the areas of plantations throughout the country by voluntary labour, thus securing to agriculture such benefits as accrue from the presence of trees, amongst which may be specially noticed—so far as has been proved by past experience—increased coolness and moisture of atmosphere; protection of crops from storms and winds; improvement of the soil by the decaying vegetation of dead leaves; increased supply of branch wood available for burning as manure; and lastly, but by no means of least importance, additional supplies of firewood, the existence of which would enable the dung of cattle to be more generally devoted to its legitimate use as manure than it is at present.

Having briefly reviewed the various points with respect to which improvements are required in Indian agriculture, and having examined the advantages likely to arise from such improvements—not merely of increased crops, which must necessarily follow upon the introduction of a more intellectual method of cultivation, but of greater security to the crops during exceptional seasons by enabling the land the better to retain moisture, and so to maintain the life and growth of crops during drought—the question remaining for consideration is—how far, and in what manner, may the experiences of this country be best introduced to the notice of native cultivators with the view to the adoption of improved methods of cultivation by them? The attempt has been made by Government, but it has practically ended in failure. By the establishment of Government farms in different parts of the Empire, presided over by experienced agriculturists, and in which the best known methods of cultivation were adopted, and so practically brought before the notice of farmers, it was hoped that the latter might be induced to adopt the improvements exhibited on these farms. The view had in establishing these farms was three-fold. (1) the introduction of scientific cultivation; (2) the teaching of improved agricultural processes for economising labour; and (3) the introduction of new staple products into the country. Referring to these farms, it is observed in the Bengal Administration Report for 1872-73 :—

"The fact remains that in practical husbandry the native agriculturists must and will beat us, until we have as exact a knowledge as themselves, of the soil, climate, and plants of the country. This" it is stated, "can only be obtained by careful and protracted observation of their modes of farming by educated European farmers, who, instead of interfering too much with the natives, will be content to watch, season after season, every one of their processes, and the way in which they encounter the emergencies of Indian agriculture. Not until we have done all this, and have become thoroughly familiar with the character and resources of native husbandry, can we hope to set up a model farm amongst them that will not bring discredit upon us by failure."

Excepting as regards the introduction of new staple products into India, these Government farms have hitherto done little towards accomplishing the objects with which they were started, and many of them have consequently been closed. In view of the opinions just quoted, of a late Lieutenant Governor of Bengal, it does not seem probable that Government farms will ever be likely to accomplish the desired object. Carried on, as they necessarily are, under an expensive supervising staff, the one great element of persuasion, viz., financial success, is wanting, and it can hardly be expected that natives will be encouraged to change their present methods of cultivation, except for one which it is proved to them by demonstration, will give suitable returns for the additional labour and outlay that would probably be required in order to adopt improved systems. It seems to the author that the best means of bringing practically before cultivators the advantages of western improvements in land culture would be through the agency of agri-horticultural societies, to whom special privileges and assistance might be given by Government in carrying out such measures as might be deemed best adapted to secure the great end in view.

In conclusion, it may be pointed out that, besides the benefits that would accrue to India herself from the introduction of improved methods of cultivation, by increasing her food supplies available for export and for home use, and by rendering the crops more secure against failure in unpropitious seasons this country also has most positive interests, direct and indirect, in the successful attainment of this object. India now supplies this country with over 3½ millions of cwts. of wheat, or between one-thirteenth and one-fourteenth of its total imports of that grain, and with the exception of the United States of America and Russia, it furnishes us with a greater amount of wheat than any other country. The advantages that would follow a vast increase in the exports of wheat from India to England would be shared by our merchants and ship-owners as well as by the growers, whilst the demand that a more scientific system of agriculture would cause for improved implements and machinery would also benefit the manufacturers of this country. Exclusive of Bengal and Assam, the area of British India under cultivation amounts to 119,528,596 acres, whilst there remain 316,127,761 acres uncultivated. It would thus appear that, after allowing ample margin for towns, pastures, forests, fallows, and other lands not immediately available for cultivation, there must yet exist immense areas capable of being brought under the plough, and awaiting only the industry and energy necessary to cause them to bring forth fruits for the service of man.

had never before seen an European, or ever visited us. If too much eagerness is evinced on the subject on first introduction to our new visitors, they will leave with the impression that, if we learn the source of the product, Government may occupy their country, and hence the information, meagre as it is, elicited from them on the point in course of casual conversation (for direct queries are out of the question) has to be received *quantum valeat.* The tribes who have recently brought down the trade mostly reside to the South and North of the "Blue Mountain," and some in territory, a large portion of which, is unsurveyed and undefined. The Commissioner remarks that his own impression is :—"that the *ficus elastica* is indigenous to the above tract of country, and that the theory of their obtaining the same from the Looshais is a blind, because, the natural outlet of the rubber trade, from the Looshai country is Demigiri in the Chittagong Hill Tracts. The relationship of the above referred to Shandoo tribes with the Looshais is the reverse generally, of that intimate and friendly kind which would allow of their obtaining the rubber for which the Looshias for some years have had a good mart in the Chittagong Hill tracts. Indirect information supplied to the Commissioner points to the fact that the "*ficus elastica*" is to a limited extent indigenous to the tract of country about ½ a degree south of the "Blue Mountain." He also expresses a hope of having time next season to learn more of, and improve "our relationship with these independent tribes, who mostly bring this article of commerce down, and who were heretofore only known to the Government as inveterate marauders on British territory" and that he will "then be in a position to afford more definite information on the subject, doubtless he observes if the Arracan Hills is the *natural outlet,* and not the adjoining frontier of Chittagong, as also if our border remains *quiet,* a trade in this new industry will be established, and that it may be regarded here as pertinent to the question that when on duty at Chittagong in September last he (the Commissioner) ascertained that for the last two years there had been a marked decrease in the amount of rubber exported from the Hill Tracts."

POISONOUS GRASSES AND PREVENTIVES.

PROFESSOR JAMES LAW, of Cornell University, gives the New York *Tribune* some notes on the ill effects from pasturing stock on grasses at a certain stage in their growth He says that much difference of opinion exists as to the wholesomeness of some of our cultivated grasses, this variance arising largely from the apparently irreconcilable results obtained with the same grass at different times and places. Some grasses are universally held in bad repute, while others habitually considered as harmless, at times appear to be seriously inimical to health and life. To the former class belongs the *Lolium temulentum,* intoxicating rye-grass or darnel, which is referred to in Mathew's Gospel as a most undesirable addition to good seed, and in the present day gives a corruption of its name, "darn," to an enzootic hæmaturia of cattle in North Britain. Numerous observations on this plant by Baillet and Filhol show that it is poisonous to all domestic animals, and that its toxic qualities reside in a yellowish fat, which can be extracted from the seeds. A similar intoxication has often been observed to arise from feeding on the other varieties of rye-grass, and notably the perennial (*L Perenne*), Italian (*L. Italicum*), and the *L. Linicola.* These last, however, are not habitually injurious, and their poisonous qualities are usually shown only at a particular stage of development, *viz.,* when they are partially ripened, but not yet fully matured. Thus the evil effects are to be seen in animals feeding on pastures that have been allowed to run to seed, and at the period when such seed is in process of ripening. If cut before the seed has been formed, or if eaten down so that the grass never comes into ear, there is no danger. The symptoms of poisoning are in all cases analogous, consisting as they do in general paralysis and drowsiness. Horses fall asleep eating or drinking, and drop the heads into the manger or trough. If suddenly startled they may drop down. The eyes are dull, the pupils dilated, and the lids semi-closed. Standing in the stall the animal may rest his quarter on the partition, while if led out he drags his limbs tardily, and sways uncertainly upon them. Signs of indigestion, rumbling in the bowels, bloating, the passage of flatus and colic pains are occasional accompaniments. Though the rye-grasses are rather famous for their poisonous properties, it must not be supposed that such qualities are peculiar to rye-grass. Millet, Hungarian grass, and even vetches, with seeds fully formed but not yet completely ripened, produce similar symptoms. Even new oats are always dangerous, though more likely to produce irritation of the digestive organs than primary brain disorder. Some grasses, like the *Stipa siberica,* a variety of feather-grass, are alleged to poison horses, while others, like short armed barley (*Hordium pratense*) and bearded oats produce serious, or even fatal digestive disorder, by simple mechanical irritation. On the whole, it will be observed that, with the exception of some few which act as mechanical irritants the danger of the whole class of gramineæ, and of such other fodder plants as vetches, belong exclusively to the seeds and at an advanced, though not quite perfected, stage of ripening. Whether used for pasture or for soiling, safety lies in utilizing them at an earlier stage of growth, and before the seeds are developed. This system of feeding close, and cutting moderately early, is a further safeguard against the ever-present danger of ergot, which developes mainly in the ripening seeds.

EXPERIMENTAL OPIUM CULTIVATION.

WHILST the *Pall Mall Gazette* sees a danger to the opium revenue from the increased cultivation of the plant in Mozambique, we may note the experiments made under the auspices of the Board of Revenue for the Lower Provinces, for the improvement both of poppy-cultivation and of the plant itself as a drug-producer. At Deegah, in Bengal, a series of experiments has been conducted for several years under special superintendence with the object of proving the superiority of ridge cultivation (as advocated also for cotton) and of selected seed, and to ascertain, moreover, the economical value of foreign species of the poppy plant. Nor have the experiments been confined to this specially selected locality, for all the subordinate officials of the department have been encouraged to carry on the investigation under their own personal supervision. The season, however; the apathy of the cultivator and his disinclination to try anything that his ancestors had not tried before him, and even the perfunctory supervision of the officials who seem, in several instances, to have carelessly accepted the cultivator's arguments against the new system, without trying to verify or disprove—all these factors have made the results of the general investigation unsatisfactory and inconclusive. In the special experiments, on the other hand, the superiority of ridge-cultivation was proved beyond dispute. Instead of the surface of the ground being caked by the application of water, the careful admission of water along the furrows allowed of the moisture being absorbed gradually from below by the growing plant. Selected seed, as is the case with every other cultivated plant, gave a larger outturn of a superior drug. But the success of foreign varieties of the poppy was not such as to recommend their general introduction into this country. The season was remarkable for moisture at inopportune periods, while the ripening crop was here and there destroyed by hail—that fatal enemy to the poppy. Apart from the particular interest attaching to these experiments, Mr. Scott's report contains information of some general interest. For instance when he describes the water in the several wells under his supervision, one of which is so highly impregnated with fertilizing saline matters that the soil, without any other manurial applications, has for many years yielded an excellent crop of potatoes and onions in the cold season, and of maize, millets, or brinjals in the hot season; whilst but fifty yards off is another well with soft sweet water with little or no fertilizing value. Mr. Scott was able also to establish the scientific fact that the function of the milk juice of the poppy is of a *protective nature* in the poppy and probably other milk-juiced plants. Caterpillars will not touch the plant when once the milk has begun to develope its special characteristic. The young plant, when the milk is bland, and the old capsules, are most liable to the ravages of the caterpillar. It had been supposed, moreover, that the extraction of the juice had a deteriorating effect upon the seed; but Mr. Scott proved that the non-extraction of the juice rather *lessened* secretion in the progeny, thus tending to spoil the plant as an opium yielder. We have hardly done sufficient justice to Mr. Scott's report, but have said enough to direct those interested in the cultivation of the poppy to some valuable information.

CACAO CULTIVATION IN CEYLON.

CACAO PLANTING goes on apace, and a short time ago a fine block of virgin forest, situated in the Dumbora valley, where the heart of the cacao enterprise may be said to beat, was advertised at Rs. 250 per acre. I have not heard, however, that this block of land has been bought, for although the affections of the coffee-planters have been somewhat enlarged of late—covering tea, cinchona, and cacao,—still Rs. 250 an acre is rather trying to the budding affection. However, there is no doubt but that cacao is a favourite, indeed, in the Dumbora valley. Several estates have gone in extensively for it, and I hear it is reported, and just wish it may be true, that the Pallekelly estate has had such a fine blossom on its young cacao trees as to warrant an estimate of as much as 30 cwts. per acre. A great deal less, however, than this would pay, for cacao nibs from the same estate brought from 75s. to 80s. per cwt. in London. I should imagine that estimating cacao will be a wilder work than even coffee has been, and that safety lies in waiting until "the day has declared it." The difficulties in getting cacao fairly started are very considerable, for while hares and caterpillars nip off the tender sprout, the white ants attack the tap root, and stay progress if not effectually check it altogether. A good plan for planting cacao is to sow the seed in an earthenware pot without a bottom, and when the plant is strong enough to stand being put out, it is shoved through and carefully put into the hole prepared for it without disturbing the roots. The pots can, of course, be used again. A difficulty often arises in getting suitable pots, but this can be overcome by using empty beer or brandy bottles, too numerous alas! about planters' *bungalows*; and cutting the top and bottom off by aid of friction, got up with a string in the way our servants here are in the habit of doing, when they want to turn an empty bottle into an oil vessel for a floating light. In sowing cacao seed it is well to remember that there is a wrong end and a right end, and that the pointed end should be uppermost. During the months of dry weather which we had here at the beginning of the year, many good-sized cacao trees lost all their leaves, and presented quite a dead appearance, but the rains revived them, and now they are vigorous and flourishing. It would seem, therefore, that the cacao tree can stand an ordinary drought without receiving much damage therefrom.—*Correspondent of Madras Times.*

THE PARIS EXHIBITION.

(*From a Correspondent.*)

PARIS, APRIL 30.

ON the left hand side of the main entrance to the British Agricultural Implement Hall is the stand of Messrs. Ransomes', Sims and Head, of the Orwell Works, Ipswich. Messrs. Ransomes have endeavoured, as far as possible, to study the agriculture of the various countries which demand the produce of their workshops, and to adapt their implements to overcome many of the agricultural difficulties which are ever present to the farmer in distant countries not so highly favoured as our own. Accordingly, at Messrs. Ransomes' stand, there are thrashing machines adapted not only for the temperate climates of England and other parts of Europe, but also for corn growing countries in warmer latitudes, such as Spain, Italy and Mexico; steam engines for burning straw, reeds, cotton stalks and other vegetable substances, as well as wood or coal; corn mills for grinding maize as well as wheat; and ploughs suited, not only for the scientific agriculture of England and her colonies, but also for the more primitive habits of the natives of India, Egypt or Russia.

The implements show that they are the result of long and careful study and of much patient investigation and costly experiment. The exhibit of the productions of the Orwell works is one of the most interesting of all, and displays a continued progress and improvement in the manufacture of agricultural implements, which will assist in maintaining the proud position which England has hitherto held in this branch of her manufactures.

The first machine of special note is a powerful steam thrashing machine, suitable for English and Colonial agriculture, and fitted with all the newest improvements. This machine is designed so as to thrash the largest amount of perfectly clean grain in the shortest space of time. The machine is fitted with an apparatus called "Wilder's patent feeder," which enables the sheaf to be delivered in a thin continuous stream into the drum by mechanical means, instead of being fed in by hand as in the old system. Parallel with this machine is a second steam thrashing machine, but designed for thrashing in hot countries. In all hot, wheat-growing countries, such as India, Egypt, Spain, &c., hay is not grown, and the cattle are fed almost entirely upon straw. This straw contains a much larger amount of saccharine matter and silica than the straw grown in cold countries, and much harder and of a more woody nature, cannot be converted into fodder in the same way as the softer English straw without tending to damage the mouths of the animals masticating it, through its hardness, and the sharp edges which would be produced by cutting it with an ordinary chaff cutter. In all hot countries up to the present time, the process of thrashing the grain has been performed by treading out the grain from the straw by walking the cattle over the sheaves of grain placed upon a mud floor. This operation always left the straw in a broken and softened state, so that it could be easily masticated, and it was found impossible to introduce steam thrashing machines into these countries until this operation could be performed at the same time as the grain was thrashed. In Messrs. Ransomes' improved thrashing machinery, the process of thrashing and cleaning the grain is performed in the same way as in an ordinary machine, but instead of the straw falling from the shakers to the ground, it passes into a hopper, in which are placed two rollers revolving at a high speed—one fitted with a series of sharp knives which cut the straw into lengths of about two inches, and the other studded with blunt projections, which split and soften the straw in the same manner as when trodden out under the feet of animals. The advantages of using a steam thrashing machine over the old system of treading out the grain are thus very great.

The engine department next deserves attention. Here is a large 12 horse-power double cylinder engine, on pedestals, fitted with reversing gear, and specially adapted for mining purposes. These engines are used in many important mining districts; where the roads are bad and it is impossible to transport the very heavy machinery generally used for hoisting and pumping in mines. The great advantage of using these engines over the more complicated Cornish engine, is on account of their extreme simplicity and the ease with which they may be fixed on an ordinary foundation.

On account of the great increase in the use of steam thrashing machines, and especially of the system of letting the machinery out for hire, the difficulty of finding horses for transporting such heavy apparatus from farm to farm has much increased, and it is evident that it is much more economical for a farmer to possess a steam horse, which would not only drive his thrashing machine mills, and other machinery when used as a fixture, but would also draw about his thrashing machine, carry corn to market, or coal from the railway, and, if necessary work a three furrow plough. The 6 horse power engine constructed to meet the above difficulty is from the newest designs, the general arrangment being the result of a long and varied experience. The boiler is capable of burning any description of coal, and can also be arranged to burn wood when necessary. This engine is coming largely into use in England, in almost every district where the roads are fairly good and the gradients are not very heavy, and I think that foreigners and the farmers in our colonies will soon learn to appreciate the great advantages which these self-propelling engines possess over the ordinary portable engine drawn by horses. In the same line with this engine stands the portable engine on Head and Schemioth's patent for burning straw, reeds, cotton stalks and other vegetable fuel, as well as wood and coal. Many hundred of such engines have been introduced into Russia, Hungary, Egypt, India and many of our colonies, for the purpose of generating steam with the waste products of the soil: that is to say, in Russia they have been employed for thrashing with straw only as fuel, in Egypt for irrigation, burning only the refuse cotton stalks; whilst in India several engines have been supplied for driving the machines used in the manufacture of tea, and the boilers have been supplied with fuel from the jungle grass, which grows in great profusion outside the tea gardens. The engine exhibited is of 6 horse power and is complete with all the newest improvements. It is fitted with a governor specially adapted for driving machinery which fluctuates very suddenly in the power required to be exerted, as for example, printing presses, electric light machines, sawing machinery, &c. This governor is said to be one of the most successful of the kind which has yet been invented.

Immediately adjacent to the heavy machinery is the exhibition of field implements, consisting of horse rakes, haymakers, and ploughs of all sorts, which occupies nearly one half of the whole space. Messrs. Ransome have long been celebrated for implements of tillage, and I think they have surpassed themselves in their exhibit at Paris.

At the end of the stand one of the patent "Star" horse rakes, of which more than 27,000 have already been manufactured up to the present time, will be noticed. The teeth are of steel, and the lever motion for lifting the teeth when full of hay is so beautifully balanced that a boy can easily work the motion. The Americans are competing largely with the British makers, and Messrs. Ransomes exhibit a light rake, of a cheaper construction, to compete against our Transatlantic friends; and although it does not possess all the refined adjustments which are found necessary in England, this new implement is in every way superior in workmanship and design to the American model, and will probably be preferred by all the large hay producers of Europe and the Colonies.

Fronting the main avenue are arranged a collection of ploughs, which extend to the back part of the stand. The first implement which claims notice is a plough with two, three, or four bodies fixed on one frame, the whole being carried on two large wheels. Although several similar ploughs are exhibited at Paris, yet it is fair to state that this type of cultivator was designed by Mr. Jefferies, one of the partners of the firm, about eight years ago, and has served as a model for most of the other multiple ploughs which are exhibited.

Adjoining the multiple plough is a new double-furrow plough, especially adapted for the requirements of New Zealand and the Colonies, fitted with circular coulters, suitable for breaking up grass land after it has been used as pasture for sheep. Of the single furrow ploughs, the first on the rank is the one specially adapted to Colonial agriculture, and, though similar in many respects to the English standard plough, yet it is made almost entirely of wrought iron, and is more substantial in some parts of its construction. The next implements are specially adapted to the large corn-growing districts of Russia and the east of Europe. They are constructed to turn a large furrow, and to break up the soil, instead of laying the furrow slice at an angle of 45 degrees, as in the English system. Last in the line is an English single furrow match plough, exhibited with the view of showing to what perfection the art of ploughing can be brought, and it is with such implements that the hard battles are fought at the English ploughing matches.

Another implement adapted to sugar cultivation, some primitive looking ploughs which find their market in India and Egypt, and also some ridging and seed-covering implements are worthy of inspection; and, indeed, in will be an easy task for a farmer from any part of the world to select a plough suitable to his soil and climate from the varied collection displayed at this stand. Lastly, a selection of lawn mowers should be noted. These useful implements are now becoming the fashion in France, for although the French do not possess the beautiful turf which exists in England, owing to the dryness of their climate, yet they are employing every means, by importing English grass seed and using English machines, to rival us in the greatest ornament to a garden—a well kept lawn. This description of the exhibit of Messrs. Ransomes, Sims and Head gives but a poor idea of the general effect of their stand, which, it need scarcely be said, is well worthy of a visit.

A NEW DENTIFRICE.

AMONG the products in the Jamaica collection sent to the Paris Exhibition by Mr. C. Grant, of Kingston, are various products of a plant popularly known in the West Indies as "Chewstick." The articles shown are bundles of the Chewstick, the same powdered, and a tincture made of it. The Chewstick, though not indigenous to Jamaica, is perhaps better known there than in other islands, where varieties of it are known. It is named by botanists "*Gouania Domingensis*," and is a very beautiful and thick bushy vine, with a profusion of foliage climbing upon the trees growing in its neighbourhood, and with a stem varying in thickness from that of a walking-stick to that of a pen-holder. The stem is very fibrous, and when these fibres are detached at the end of a section of the stem by *chewing*, becomes a rude but most perfect tooth brush, giving out in the mouth when rubbed over the teeth, a thick saponaceous froth of a pleasant aromatic bitter taste, which remains in the mouth for some time, and which serves, not only the purposes of a tonic bitter when used in this way, but also whitens the teeth and hardens the gums; on this account, it is extremely popular in Jamaica as a dentifrice amongst all classes, and has attracted a good deal of favour in foreign countries. It also possesses another peculiar property—If a quantity of the bruised vine be steeped in water, wort, beer, or any kind of watery infusion, there is communicated to it a warm, bitter, aromatic taste, and if the fluid so treated be poured out from one glass into another, it will be found to have acquired all the appearances of beer (*minus* its alcoholic flavour) in a high state of fermentation; on this account, the Chewstick ought to be very useful to brewers and others of this class, since stale or immature beer would be much improved by its use, giving to such fluids a warm aromatic bitter taste, more agreeable than that given by hops, though certainly it does not possess the narcotic principle which makes hops so indispensable to the brewer and others.

The saponaceous mucous, which is the main characteristic of Chewstick, is also freely communicated to dilute spirits of wine, and on this account a dental tincture is sold, made chiefly from it. This is sold freely not only in Jamaica, but in England, America, and Germany. If a teaspoonful of this tincture be poured into half a tumblerful of cold or tepid water, it makes one of the best and most unique mouth washes one could wish; and if a few drops be poured upon a wetted tooth-brush and applied to the teeth, they become quite filled with a thick saponaceous froth, which leaves the teeth quite clean, and a sense of warmth and relief is experienced for some hours afterwards.

The Chewstick is also sold in a powdered state, and when the powder is used with water and a tooth-brush in the ordinary way, the same effects described are freely produced. In short, the article is quite unique, and were brewers and others to try it as a substitute in some cases for hops, or as a means of economising them when used for brewing, they would derive much advantage from its use. It has never, so far as we know been suggested for any purpose of this kind, but ginger-beer sellers used it very freely in Jamaica to give their wares a semblance of fermentation, and on this account the teetotalers might gratify their taste for beer without a sacrifice of their principles.

FENCE POSTS TOP END DOWN.

A STUDY of vegetable physiology led me to try several experiments many years ago, to throw light upon this question. The sap or moisture goes up in the sapwood from the roots to the leaves of the trees. I found if the post is butt end down, the pores are open upwards and water can go up and thus keep the post moist between wind and water, which must cause a rapid decay. It appeared probable that the pores were open only upward, and not downward in the tree. To test this, I cut a small maple sapling (two inches through) in May, having the limbs all on, and placed the butt end in a pail of brine. In thirty-six hours, the leaves were saturated with this brine, the taste of salt being strong.

At the same time I had cut off the top branch, leaving the rest of the limbs. After winding a cloth round the butt end to prevent evaporation, I placed the top end in a pail of brine and allowed it to remain several days, but no brine had been absorbed at the top end. It had not penetrated the pores as far as the end was immersed in the brine, for if the bark was scraped, there was not the slightest taste of salt to be found. This being the case in the green tree, how much more must the pores of the dry tree be closed from the top end downward? I have tried many similar experiments, and think the question settled that if a post is placed top end down, no moisture can ascend from the bottom of the hole up the post to rot it; but when the butt end is down, the moisture can ascend the pores very rapidly if green, and slowly if dry. Seasoned posts are found to last much longer, because the pores are more or less filled within the seasoned wood. I should also infer that placing the top end down, would make more difference in a green than in a dry post. In pursuance of the fact that the pores of green timber had been often saturated with different solutions, to preserve it, by immersing the butt end freshly cut in the solution to be absorbed, it will also be noted that burning or charring the posts only closes the pores and prevents the absorption of water.—*Country Gentleman.*

THE GARDEN.

AMATEUR gardeners in the plains are much put about during the hot months for the means to protect ferns and other delicate foliage plants from the scorching rays of the sun, and the withering effects of the land-winds, under the combined influence of which, plants either die or become sickly. To keep the sunshine from them altogether, is equally injurious. What they require are an intercepted sunshine and shelter from the land-winds. Amateurs might take a hint from the plan adopted by Captain Maclaverty of Madras. It is simple, but admirably adapted for growing foliage plants with success. It consists of a pandal, or fern house, with a covering of fine lattice work of bamboo. The sides are protected with similar material of coarser workmanship, but the side exposed to the west is lined half-way with *tats* and covered with creepers. By this arrangement the plants have the benefit of the sunshine without the intense heat, the rays being intercepted and modified by the lattice work above. In a properly constructed fern-house of this description, one might stay a considerable time without being much inconvenienced by the rays of the sun.

We take the following from the *Gardener's Chronicle* of the 25th May last.

"I am indebted to Messrs. Thompson, of Cloverfords, for giving me the simple advice to syringe plants infested with bug and scale insect with water diluted in the proportion of one wineglassful of paraffin oil to four gallons of water. The oil and water must be first thoroughly mixed with the syringe, one quist into the can, and one on the plant. I have used it on oranges, gardenias, crotons, and many other plants which had bug and scale on them, and, while it does not injure the young leaves in the least, it is certain death to the insect."

A correspondent very justly remarks, "if the oil is certain death to scale and bug, it should also be so to the tea red-spider, and would not be an expensive cure."

Red spider has become a very serious pest in this district, and it is certainly getting worse year by year; any cheap practical mode of removing it off the face of the earth would therefore be an immense boon to tea growers. A few quists would cost very little, a pint or two of paraffin oil would be a very inexpensive investment, and the total expenditure in experimenting on half an acre of tea would hardly cost Rs. 10; while if the paraffin and water killed the red spider effectually, planters would find it to their advantage to use the solution immediately red spider made its appearance on any of their bushes.

It was announced in a recent issue of the same paper that the stuff used at home for clearing sheep of insect, known as "Chemical Fluid," had been found effective in ridding plants of bug and scale insect. The proportions used were a tea spoonful of the "fluid" to two or three gallons of water.—*Darjeeling News.*

THE *Indian Flower Garden* (published by Messrs. W. H. Atkinson and Co.)—will recommend itself to all who are fond of gardening. The *brochure* contains a list of nearly all the flowers that will grow in the plains, and gives simple directions for their culture. Those who are not satisfied to leave all to the native *mallee*, but would like to cultivate new varieties of plants, either by importation or hybridising, would do well to get this little *vade mecum*, as it is evidently written by one who speaks from knowledge and experience.

WE are ready to believe that the *Scientific American* is taking 'a cheerful rise' out of us when we read of the transformations by which, it assures us, our sweetest perfumes are obtained from sulphuretted hydrogen, or something worse:—

"To chemistry modern perfumery is perhaps more indebted than any art that ministers to the luxury of life. It is commonly supposed that all floral essences are the product of distillation; nothing could be a greater mistake; nearly every perfume of the toilet bottle or sachet of the mouchoir case is the product of waste matters—some of them odourless, others most intensely nauseous and disgusting. Many a fair maiden damps her brow with the 'Extract of Millesfleurs,' innocent of the knowledge that its essential ingredient is derived from the drainage of the cow house! The perfumed toilet soap is scented, and confectionery flavoured with oil of bitter almonds artificially prepared by the action of nitric acid on the fetid oil of gas-tar. The pure 'fruit sirups' of some of the soda water vendors are made from factitious oils that chemists have learned how to produce. Singularly enough, too, the latter are usually derived from substances of disgusting odour. The oil of the pine-apples is obtained from a product of the action of putrid cheese on sugar; or by making a soap with butter, and distilling it with alcohol and sulphuric acid. The peculiarly fetid substance called 'fusel oil' serves as a base for several artificial flavours; thus, distilled with sulphuric acid and acetate of potash

it gives oil of pears; with sulphuric acid and bichromate of potash the product is oil of apples. And so, too, by other means known to the chemists, refuse corks are made to yield essence of mulberries, tallow to put forth essence of melons, and the wood of the willow tree to part with oil of wintergreen indistinguishable from the genuine article."

Those of our readers who may like to read the article *in extenso*, will find it in the Evening Supplement of the *Statesman* of the 10th July.

THE LUCKNOW HORTICULTURAL GARDENS.

THE report on the Gardens for the year ending the 31st March last has been published. In the transfer of Dr. Bonavia, the superintendent, to another district the gardens sustained a serious loss. The Doctor is an ardent lover of botany and has always taken great interest in the gardens, the management of which devolves upon Mr. Ridley the head gardener who has worked under Dr. Bonavia for the last four years. The abnormal season, drought and frost told severely upon the plants; at one time the entire establishment was employed day and night irrigating. In the previous year's report a falling off in the sale of acclimatized flower seed was reported, and a large quantity was distributed gratis, in order to make the garden produce known. The result was eminently satisfactory, the amount realized under this head being double that of the previous year. Mr. Ridley's experience in this matter is that the acclimatized seed germinates more quickly and with greater certainty than that imported, and that the plants raised from it come into flower sooner, and flower longer and more abundantly than those raised from imported seed. But "the flowers of many kinds are somewhat smaller, and the colours not so deep and bright; but why a supply of flowers and a good display are chiefly looked for, acclimatized seeds will be found to give the best results."

There are now no less than twenty-eight kinds of *Eucalypti* growing in the Garden. The experience of the past year confirms the high opinions expressed by Dr. Bonavia as to the value of the *Eucalyptus rostrata* as a quick growing, hardy tree The average height of the trees planted in 1875 is about thirty feet; several measured at three feet from the ground 13, 14, 15, and 17 inches round. A number of *Eucalyptus Sideroxylon* planted in 1876, have also maintained a steady healthy growth, and several of them are 15 feet high. It is quite distinct from the *rostrata* both in leaf and habit of growth, the leaves are narrow, and the branches numerous and slender. It has proved hardy and seems as well adapted to the plains as *Eucalyptus rostrata*. The most noteworthy point connected with these plantations is that no artificial watering has been given since the trees were planted; at no time have they seemed to require it, not even during the long continued drought and heat last year. Mr. Ridley therefore regards the hardiness of these two species as proved, and the results generally as encouraging evidence in favour of extensive cultivation. Some experiments were made with the object of ascertaining the results of planting *eucalypti* in very poor soil, but the results were unsatisfactory; the plants required constant hand-watering.

The experiments with Egyptian or Bamieh cotton had much the same results as elsewhere. The plants maintained a healthy and vigorous growth till checked by cold in November, by which time some of the plants were nine feet high, and the average height of the plot from five to six feet. The produce was small and the staple exceedingly long. It is possible however that the deficiency in quantity is more than made up in the quality of the fibre, which is soft and silky, and at least twice the length of common country cotton. Mr. Ridley says:—"There were two distinct kinds of plants, which I have labelled Nos. 1 and 2. No. 1 was of tall upright growth, with few side branches, and which I take to be the true *hybrid*. No. 2 was of bushy spreading habit, with several side branches nearly as large as the centre stem, and which appears to be ordinary Egyptian. Whether the seed was mixed, or has a tendency to revert to the cotton parent, is a point to be settled by future trials; to this end the seed of the two kinds has been collected and kept separate. It is, however, possible that the flowers of both were cross-fertilized, as the plants were grown side by side; and should the seed of No. 1 again produce two kinds of plants, it must not be concluded that the *hybrid* is wanting in fixity and permanence of character. Should the crop be of two kinds and pure seed be desired, care should be taken to pull out all plants of bushy spreading habit before they come into flower, and if the crop is grown at some distance from other kinds of cotton, true seed is likely to be produced."

Mr. Ridley suggests that it would be advantageous to import large quantities of Belgian carrot seed for distribution among intelligent cultivators. This carrot is greatly superior to the common country kind; but the North-West Government thinks it is doubtful if the cultivation of any carrot, the seed for which has to be imported annually, will be sufficiently remunerative to a native cultivator. The attempts to obtain good seed from plots sown in the garden have hitherto failed, chiefly, according to Mr. Ridley, because the plants were not carefully selected. Another attempt is being made this year to procure good seed.

The Horticultural School, useful as it might be made, does not flourish. Want of funds necessitated the dismissal of seven out of the twelve boys entertained. For the present year sufficient provision has been made in the budget to prevent such a step being again necessary.

The Horticultural show was, as usual, a success.

The financial condition of the Gardens, in spite of the adverse season, is most satisfactory. The receipts amounted to Rs. 9,729-4-3 or Rs. 335-14-3 in excess of the receipts of 1876-77, and Rs. 1,234-13-1 in excess of the estimate. The expenditure amounted to Rs. 8,709-11-9, or an excess over the estimate of Rs. 206-4-7, but a balance of Rs. 1,028-8-6 remains in the Government treasury to the credit of the Gardens.

SAHARUNPORE BOTANICAL GARDENS.

THE *Gardener's Chronicle* for June describes the Saharunpore Botanical Gardens; and also the two affiliated gardens on the Himalayas, the one at Musoorie, the other at Chajari—2,500 feet below the Mussoorie ridge. The Saharunpore Garden dates, as an institution, from the Rohilla Government in the days before 1817, when a small part of the present site was known as *Farhat Baksh*—or, "delight-giver." After this part of the country had passed into possession of the English, the garden was placed under the care of Dr. Goran as Superintendent. He was succeeded in turn by Dr. Royle, Dr. Falconer (the eminent palæontologist), and Dr. Jameson. For thirty years Dr. Jameson was employed in the introduction and cultivation of many valuable plants, especially of tea,— with the successful establishment of which in India, his name should always be associated. After his resignation in 1875 the duties were carried on by the head gardener, till the appointment of the present Superintendent, Mr. Duthie, a pupil of the famous Dr. Hooker of Kew,—and a gentleman already well known for his scientific, and especially botanical, attainments. The objects of the Saharunpore Garden and its hill sisters are three-fold,—scientific observation, practical experiment, and distribution of plants, &c.,—of all which objects the utility has been tested and proved. The first could be in no better hands than those of the present Superintendent, whose close connection and correspondence with what may be called his Alma Mater, the Royal Gardens at Kew, ensures mutual interchange of the latest scientific results and constant addition to botanical knowledge. To confine the superintendent's duties merely to the management of a large kitchen garden or nursery would be another instance of using razors to cut whetstones. He should be permitted at times to travel in the interior for botanical research, and to complete the work left undone by Sir Joseph Hooker and Dr. Thomson. The purely mechanical work of acclimatizing trees, plants, or kitchen vegetables, might be safely left to a properly trained gardener like the late Mr. Nisbet, whose place, by the bye, is still unfilled. The results would reach the public after receiving a thorough test by a scientific expert. In the Saharunpore Gardens, experiments are made as to the suitability of the eucalypti, the prosopis, and the ceratonia siliqua (carob) for propagation in India. A considerable area of ground is devoted to the cultivation of the Rheea for purposes of future experiment; and the "compound" is studded with the handsomest trees that could be collected in one spot. A fine avenue of casuarinas leads from the gate to the Superintendent's house. These gardens, till lately, had the reputation of being most unhealthy; but considerable improvements in drainage, &c., have made them a favourite place of resort for scientific observers and pleasure-seekers. Attached to the gardens there is a museum containing many objects of considerable interest and value which, when better arranged, will form the foundation of a very fair and instructive representation of the products of the North-West. The collection includes specimens of the Himalayan flora, Sowalik fossils, woods, fibres, birds, &c. Frequent additions are made by interested correspondents, and the existence of such an institution only needs to be more generally known for it to receive from all who (in however small a degree) are workers in the fascinating pursuit of scientific inquiry.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Thursday, the 27th June 1878.

THE HON'BLE LOUIS S. JACKSON, C.I.E., *President, in the Chair.*

THE proceedings of the last meeting were read and confirmed.

The following gentlemen were elected members:—

Messrs. F. T. Read H. A. Adkin, J. M. Darwood, C. S. Kirkpatrick, E. Drouin, Dr. M. E. Battersby, Manager Mutuck Tea Company, Capt. C. J. Wilkinson, Major R. F. Angelo, Manager Hoolungurree Tea Company, Assam, Secretary Municipality of Mau, Manager of the Tukvar Tea Company, Baboo Rajendronath Mookerjee, and Manager of the Phœnix Tea Company, Cachar.

Mr. George Takedo, of the Interior Department, Japan, was proposed a member; and the names of Lieut. Henry Grey, Ranchi, and Dr. C. Prentis, Goruckpore, were submitted as having rejoined.

The Hon'ble the President announced a donation from His Excellency the Viceroy (Patron of the Society) of Rs. 500, and put in for record the following extract of a letter on the subject to his address from the Private Secretary :—

"His Excellency has much pleasure in giving the Agricultural and Horticultural Society a donation of Rs. 500, for which I enclose a cheque herewith, and regret that it escaped his memory at the time he accepted the position of Patron.'

CONTRIBUTIONS.

1. *Report on the experimental culture of the opium poppy for season 1876-77. By* John Scott. From the Government of Bengal.

2. *The Indian Forester*, Vol. III, No. 4. From the Editor.

3. *Journal of the Asiatic Society of Bengal*, Part 2, No. 1, 1878, and *Proceedings* for April and May 1878. From the Society.

4. A further supply (12 pounds) of Bamia (Egyptian) cotton seed. From Mr. J. C. Chapman, Alexandria.

Mr. Chapman mentions that this seed is genuine, though it is difficult to procure now unadulterated, being generally mixed with Ashmouni, and sells for £30 the *cantar*. "Here," adds Mr. Chapman, "the Bamia plant is *mostly a failure*, requiring an immense deal of water, and growing too tall, as high as 13 feet."

This seed is available to members desirous of trying this new kind of cotton.

5. A packet of mahogany seed from Jamaica. From Dr. G. King. (Transferred to Garden.)

[Since the meeting a further large quantity of seed of this valuable tree has been presented by Dr. King, with the following directions for sowing :—"Put the seeds into the soil so that the broad thick end of each seed shall be lowermost, and let only this part be covered, leaving the thin end sticking out of, and uncovered by, the soil. Keep in a shady place under cover, and water gently. Transplant the seedlings into pots when three or four inches high." This seed is available for members.]

6. Seeds of *Terminalia melanocarpa* and *Delabech rupestris.* From the Queensland Acclimatisation Society. Mr. Bernays states that the first-named tree affords a beautiful shade, the second is their curious "bottle tree."

7. A small quantity of Indian-corn raised in the Boolundshuhur district. From the Director, Department of Agriculture, N.-W. P.

8. A small quantity of acclimatised seeds. From Dr. O'Brien of Roomaree, in the Debrooghur district.

The following is an extract of Dr. O'Brien's letter to Messrs. Balmer Lawrie & Co., dated 24th May :—

"I am sending down a parcel of seed for the Agri-Horticultural Society, which I shall feel obliged by your making over to the Secretary. The seeds are those of the *Reana luxurians*, cauliflower, Indian pink and convolvulus.

"Last year I got a very small quantity of the *Reana luxurians* seed, a few of which germinated, and from these plants I got a large quantity of seed last cold season. I have distributed some in the district to a few of my friends. I think it is a very valuable fodder for cattle, and will pay us to grow. I have planted out six to eight acres of land with it for our cattle.

"The cauliflowers from which I saved this seed were some magnificent ones I raised from seed I had saved the year before. These cauliflowers were much superior to those got from imported seed, and if properly treated, with plenty of manure, ought to produce superior flowers next season.

"*Eucalyptus globulus.*—About 3½ years ago you sent me up some of this seed, from which I got a large number of plants. They grew so vigorously during the first year, that I became certain they would succeed here. I was however mistaken, nearly all have died out, and now I have only two plants left. Both very seedy looking, and which I expect will die during the current rainy season.

"The *Eucalyptus rostrata*, however, seems to me will thrive here. I have plants now over eighteen months in the ground, and none show any signs of decaying. Some are from eight to twenty feet high, but very slim, and require to be kept propped up to prevent them tumbling about.

"The flower seeds are from plants raised from seed supplied by the Society."

9. A fine healthy plant of the "Cannon ball tree," *Couroupita guianensis*, from Mr R. M Daly, on behalf of the Superintendent of the Botanic Garden, Pondicherry,

10. A quantity of Sunflower seed, from Mr. F. H[illegible].

GARDEN.

The following memorandum from the Gardener regarding the bone-dust and powdered castor-cake which were presented in September last by Mr. Greenhill, of Messrs. C[illegible]k & Co., was submitted :—

"These manures were used with cabbage, cauliflower, and tomatoes, roses, and annuals, and the result showed that the bone manure was beneficial, but the castor had no manurial effect; both were used in the same proportion. There was something in the castor that had an injurious effect on foliage when exposed to the sun. The bed of roses manured with bone is now much in advance of the other.

UTILIZATION OF CERTAIN PLANTS IN TIMES OF SCARCITY.

The following letter on the above subject, from Captain J. F Pogson, was next recorded :—

"I have this morning been overhauling my collection of seed and papers, and enclose a small parcel of seeds of a plant quite unknown to me, but which from its appearance, peculiar growth, and form of seed pods I look upon as a fibre-producer. (These seeds belong to a *Crotalaria*; they have been sown in the Garden.)

"The dried flowers and leaves were preserved, but owing to m[illegible] moves they are *non est inventus*. The flowers are magnificent, [illegible] very large sweet peas, color deep gold, scent very agreeable, and partaking of the heliotrope and sweet babool, (*Acacia farnesiana*.) They grow in spikes like the common 'saim' of Bengal.

"I wanted a lot of convolvulus seed for covering an unsightly sloping bank or hill cutting. On inspecting the seed procured from the bazar, I noticed some very curious ones, and had them all picked out and sorted. All were sown; some did not germinate, but the kind under notice came up in some places. It was allowed to grow, attained a height of from three to eight feet, single thin stems, with flower spikes. The seed pods were like peapods, from 1½ to 2 inches in length. When ripe, the seeds rattled in the pod on the stem being shaken. The seed pod of the '*Sun*,' resembles one of these seed pods on the large scale.

"I should like the seeds to be cultivated to ascertain what the plant really is. The soil should be limed before sowing, which may take place on receipt. I have kept sufficient seed for my own sowing, and if the plant proves to be a fibre-producer, its value is evident; if not, we have a beautiful garden flower. On looking over my notes, I find amongst those of 1871, one which is likely to prove of very great value to India at all times, and especially so when famine is to be the order of the day.

"I enclose a copy of the note for submission to the Council of the Agri-Horticultural Society of India in view to action being taken in the matter if thought fit. In a case of such importance, State aid should be forthcoming in the shape of cash. If referred to the Secretary of State, London, it may take two or three years to obtain the seed and some young plants, whereas the Society could procure both in six months.

"The babool (*Acacia Farnesiana*), and keekur, (*Acacia catechu*) are now in pod and will ripen seed in all May. The seeds are produced in very considerable quantities, and are wasted. In 1873, whilst at Umballa, I operated on some seers of seed, and after giving them a good long boil, I was much pleased to find that the very hard seed under the action of hot water boiled quite tender, and was fit for use as cattle food.

"The pods of both kinds, before the seeds ripen and harden, are freely used by goatherds and cowherds, as cattle food. But the ripe pods are neglected, and allowed to rot. The dry pods (*i e.* the shells) contain a large proportion of tannin, and will tan skins, and make ink and brown dye, with sulphate of copper. This letter is written with ink made from 'keekur' pods and sulphate of iron. It struck me, that if the pods and seed could be eaten by cattle in their immature state, the ripe seed could not be devoid of value as cattle-food, if the hardness of the seed could be got over. The experiment followed. But as I had neither goat nor cow, the boiled seeds were thrown away.

"I dare say soaking them till about to sprout would answer as well as boiling."

The following is the note alluded to by Capt. Pogson. The Candle tree was introduced into the Royal Botanic Garden some years ago, but has not yet seeded :—

"CANDLE TREE.—"*Parmentiera cerifera*, (Seem) *Palo de velas, or Candle tree*, Valley of the Chagres, South America.

"This tree has received the above name in consequence of the similarity which its fruit bears to a candle. The fruit has an apple-like odour, and is used for feeding cattle, for which purpose it is of great value, being produced in its greatest abundance during the dry season, when vegetation is all destroyed by the sun."

In connection with the above a communication as follows, from Mr. P. R. Tottenham, was next submitted :—

"Every one has heard a great deal about the famine in this country and that a very large sum of money has been received from England and other countries to help the poor unfortunate people. Also that there is a commission appointed to enquire into the best method of preventing similar occurrences. Railways and canals also have their advocates. I believe that both are equally useful, but would confine the latter altogether to irrigation instead of trying to compete with Railways.

"Permit me to suggest to the Commission the advisability of Government holding out a reward for extensive planting of trees throughout the country.

"In Canada the climate has of late years been so dry, since the wholesale destruction of the fine forests there, that a general outcry has been raised about the want of rain. The Government have found it expedient to have enquiry set on foot respecting the reasons for the want of rain, and have lately held out rewards for the planting of trees through the country generally, and particularly so on the sides of the roads, giving the owners of the ground exclusive rights to all trees planted there by them, and making it punishable for any one to damage any such tree.

"The Agricultural Societies in every county and township also hold out rewards and prizes for the farm on which the greatest number of trees are planted. I should think that some such arrangements might be carried out in India, and believing it would confer a lasting benefit to the country in general, has induced me to trouble you with these suggestions.

"*P. S.*—I may also say that our rule respecting blight, &c., in grain, is to blow our seed-grain quickly through our fanning mills, to get rid of all imperfect grains, which cause smut, &c., and when well cleaned, to wash our seed grain with water in which a strong solution of salt and some bluestone is poured: by following this method farmers will soon reap the benefit at a very small cost. The salt-water to be effective must be strong enough to float an egg."

Letters were read :—

From Director, Department of Agriculture, N.-W.P.—

First —Applying for seeds and for further information r[illegible] its house I
fibre-yielding plant "*Malaokra capitata.*" Referenc[illegible] favoured
Bombay; seeds not procurable here. A copy of [illegible] the action of
and which gives all the information we [illegible] pure 'fruit sirups' of
the journal) will be sent shortly. are made from factitious oils that
Second,—Applying for [illegible] produce. Singularly enough, too, the
grass *Festuca dives*, referr[illegible] from substances of disgusting odour. The
have been made from [illegible] obtained from a product of the action of
glad to be enabl[illegible] sugar, or by making a soap with butter, and
tion made to [illegible] alcohol and sulphuric acid. The peculiarly fetid
further suppl[illegible] 'fusel-oil' serves as a base for several artificial
Third.—Su[illegible] distilled with sulphuric acid and acetate of potash
the gardens of [illegible]
for publication in [illegible]

Fourth.—Inquiring if any seeds can be supplied of the Cacao plant, and information as to its habit, soil, cultivation, &c. The following memorandum forwarded in reply:—

"*Theobroma cacao.*—Seeds of the above are not available. A few trees were introduced some thirty years ago into the Agri-Horticultural Society's old garden, but they all died down in the course of a few years. There are several plants, I am informed, now growing in the Royal Botanic Garden, Calcutta, shaded by a mangoe tree: they are from five to seven feet high. There was a large tree in existence before the cyclone of 1864 (which destroyed it). This tree is said to have seeded.

"The habitat of this tree is tropical America, but it is now grown in the West India islands—Trinidad, Grenada, and St. Lucia. It requires a rich soil for its proper development. I annex an extract regarding the culture from a paper on the Culture and Preparation of Cacoa, which is to be found in the *Society's Journal*, Vol. IV, old series."

From the Consul-General of France, enclosing extract of a letter from the Agricultural Society of French Cochin-China, regarding the serious depredations of a caterpillar on their rice fields. Enquiring if it is known in India, and what remedies are employed to modify its ravages. Specimens of the insect applied for.

From Colonel J. B. Fisher, in reference to a caterpillar plague at Fort Shubkudder near Peshawur:—

"Thank you for sending the seeds I asked for: I think of sowing the *Reana* near [Murree]," writes Colonel Fisher, "our garden in Shubkudder is perfectly overrun and eaten up by caterpillars. We have tried tobacco water with *no* result, and as for taking them off the plants, it would be more then twenty men could do, employed all day and every day. I have never seen anything like this caterpillar plague in any part of India. *I should be most thankful to anybody who could suggest a remedy, as I believe we may expect the same plague more or less every year.*"

From the Superintendent of Forests, Rangoon, applying for fresh tea seed. (To be complied with in proper season.)

From J. E. O'Conor, Esq., applying for some good American varieties of tobacco seed for despatch to the Commissioner of Arracan. (Complied with.)

From the Rev. W. G. Hunt, Hazareebaug, submitting a sample of cotton raised from New Orleans seed, and asking for a report thereon. His cultivation is 4½ acres, and he would wish to extend it considerably, if it would be likely to pay. This cotton is of fair length, strength, and good color, though not quite equal to original stock.

From Mr. E. W. Presgrave. Remarks on the treatment and propagation of the Amaryllis tribe.

FORESTRY.

THE INDIAN FOREST SERVICE.

BY order of Her Majesty's Secretary of State for India, an examination is to be held this year on the 20th of November and following days, "to select five young men, *if so many are found duly qualified*" (the italics are not ours, although we believe that under existing circumstances they are quite necessary), "to be trained in France for the Forest Service of India."

They must be natural-born British subjects, between seventeen and twenty-one years of age, and unmarried. Each must furnish to the Revenue Department of the India Office, satisfactory evidence of his parentage and birth, and a statement of the consent of parents or guardians, along with testimonials of good conduct for the two previous years. A statement of the places where they have received their education since they were nine years old must be furnished by applicants, and also proof that they have attained a certain standard of proficiency in the following branches of knowledge:—

I. English Writing from Dictation, and English Composition.

II. Arithmetic in all its branches.

III. Algebra, up to and including the Binomial Theorem.

IV. Geometry and Plane Trigonometry.

V. Elements of Botany, Geology, Mineralogy, and Chemistry.

VI. Surveying, Land Measuring, Plan Drawing, and the use and adjustment of instruments.

VII. A good colloquial knowledge of French, with facility of translating from that language.

by si[illegible] is given to candidates who, in addition to the above,
plants, it m[illegible]
fixity and perf[illegible] in translating into French, in Free-hand Draw-
kinds and pure seed of Mechanics and Physics.
all plants of bushy spreading [illegible] active habits, and possess
and if the crop is grown at some distan[illegible] hearing. They have
true seed is likely to be produced."
Mr. Ridley suggests that it would be advan[illegible] the Indian Medical
quantities of Belgian carrot seed for distribution [illegible] capabilities
cultivators. This carrot is greatly superior to the co[illegible] retary of
kind; but the North-West Government thinks it is do[illegible] who have
cultivation of any carrot, the seed for which has to
annually, will be sufficiently remunerative to a nati[illegible] seems best
The att[illegible] to obtain good seed from plots sow

adapted to the Service. The accepted candidates have then to proceed to the School of Forestry at Nancy, in France, to undergo a "training of two years and a half in the management of forests and the science of forestry, in surveying, road-making, and the natural sciences." They are expected to always conduct themselves in a proper manner, to obey the injunctions of those appointed to instruct them, to use due diligence in their studies, and to zealously improve every opportunity for learning. Any candidates failing to satisfy these conditions, or otherwise proving unfit for Indian Forest Service, will be cashiered on the report of the officer superintending their studies. Periodical examinations will be held to test their progress and proficiency, and those who fail to reach the required minimum number of marks are liable to be peremptorily removed from the school, and to forfeit all claims to enter the Service.

The necessary expenses of a pupil at the Forest School of Nancy are said not to exceed £180 *per annum*, or £450 for the whole course of 2½ years. To those candidates whose conduct and progress is satisfactory, the Secretary of State makes an allowance of £150, towards reducing this heavy cost. This expense is altogether exclusive of school fees, which amount to £100 for each pupil, and are paid by the Secretary of State.

The parents or guardians must pay in advance, at the rate of £8 per month, for the maintenance of each pupil; the first instalment, £96 for eight months, being payable before the course of training commences, and the remaining four instalments of £72 each on the 1st of May and the 1st of November in each year. "The difference in *excess*" of the amount of maintenance, £384 for the whole period of 2½ years, "for journeys and amusements can be paid at discretion by the parents, either direct to the student or through the school treasurer."

After finishing the course of instruction at Nancy, and before departing for India, the candidates are required either to visit the Scotch forests, the dockyards, or some of the timber slides in the Vosges or Black Forest, or to undergo a short course of botany at Kew, as may in each case be deemed most expedient.

Articles of agreement must be signed by each candidate within a month of his nomination as Junior Assistant, and he must forthwith embark for India when required by the Secretary of State, who provides the expenses of the passage. On arrival in India he must report himself to the Government, when he will be posted to such parts of the forests as the Service may require, pay being allowed from the day of his arrival in India, at the rate of Rs. 250 per month, or £300 a year. When he reaches the place of his appointment the forest officer becomes entitled to all the rights and privileges of an officer of the Forest Department, in accordance with the rules and regulations for the time being.

Such is a summary of the present mode of selecting and training candidates for junior appointments in the Forest Department in India. With the required mental and physical capacity, and the educational standard of proficiency, no one will differ to a greater extent than to advocate a higher standard than has hitherto prevailed; but the excessive and compulsory expense to which candidates are subjected by being compelled to go abroad for their scientific training, which can be equally well or better taught at home, proper means being taken to do so, renders the scheme quite worthless for obtaining those men who are best qualified by nature, mentally and physically, to fulfil the duties of a forest officer in India or elsewhere. There is not a "forester" in this country whose unaided income will allow him to train his sons, or those in whom he may be interested, to fill such appointments, owing to the wasteful and, what ought to be, unnecessary expense of sending candidates to Continental Forest Schools. These and such like men, "hardy sons of toil" though they be, are both able and willing to undertake the hardest and most difficult of foresters' duties in any part of the world, and to carry them on with untiring energy and never-flagging zeal, so as to commend the most attainable success. Not but that some of those nurtured in the lap of wealth and plenty may make excellent forest officers, but few of such have a natural taste for the profession, or the energy and endurance to bear up against the unavoidable hardships, rough life, and to them unremunerative pay of a forester.

We for the present leave it to the reader to work out the problem, What is the *total cost* of a candidate for the Indian Forest Service, from the time he leaves school till he lands "duly qualified" to draw pay in India? The result will surprise most of our readers, and will go far to convince those who are still in doubt as to the utility and economy of immediately establishing a British School of Forestry. An equal amount per pupil of Government money, expended upon a properly equipped institution at home, would give a much more valuable and enduring return to the country, India, and the Colonies, than the present expensive foreign system has done, or is ever likely to do, and at the same time bring the pupil's necessary expenses within the means of all industrious people.—*Forester.*

INDIAN WOODS AT THE PARIS EXHIBITION.

THE Paris Exhibition has been supplied with an excellent series of specimens of Indian woods and other forest produce. The collection is admitted to be not as absolutely complete as the Inspector General of Forests would have desired; as the time was to a certain extent limited, and the distances and difficulties of carriage to be got over in collecting good specimens from all parts of British India very great; for instance, some of the specimens from Mysore could not be forwarded in time for the Exhibition on account of the difficulty experienced in getting carriage owing to the famine. But altogether a fairly complete series of the important forest products of India has been forwarded, all of which have been most carefully arranged and named.

The number of wood specimens exhibited is 650, which includes 370 different species. One of the chief objects has been to shew together specimens of the valuable woods of India collected from as many different regions as possible, so as to form a series illustrating the different growth and different qualities in different climates. In addition to these 650 specimens, there are 32 large planks, 16 climbers, 28 bamboos and 16 canes and other palms; while of minor produce the list contains 100 specimens of gums, resins, lac, oils, varnishes and caoutchouc; 88 specimens of fibres, bark, flowers, and leaves used in rope and paper-making, for dyeing, and other purposes; 93 specimens of fruits and seeds, and a number of miscellaneous articles. The duty of unpacking and arranging these, which should necessarily be done by a person acquainted with the subject, has been entrusted to Colonel Pearson, who is at present in France, and the sum of £100 has been placed at his disposal for the purpose of providing stands, glass bottles (for seeds, gums, oils, and resin) and other requirements for arranging the specimens as well as for repolishing any that may have suffered in transit. One considerable advantage arising from the collection of forest produce of all parts of British India is that it gives the opportunity of each piece being carefully examined and recorded and the authentic name of all doubtful specimens decided. The catalogue of specimens sent to the Paris Exhibition which is published in Calcutta, gives the authentic nomenclature and district of almost all the forest produce in India. The Forest Department propose shortly to publish a descriptive account of the structure and mechanical qualities of the different woods examined during the preparation of the selection. At the close of the Exhibition it is intended by the Government that the collection shall be presented to the Nancy Forest school, where for the last 10 years a large proportion of the forest officers in India, have received their professional education.

As, in order to obtain good specimens for the exhibition, it was necessary to have large pieces of timber &c, it was found that sufficient material was available to send sets of specimens to the Indian Museum in London, to the Royal Gardens at Kew, to the Indian Engineering College at Coopers' Hill, and with the view of bringing some of the more valuable Indian woods to notice on the Continent and in America, specimens are being sent at request to the Konigliche Landwirth Shaftliche Museum at Berlin, to the Polytechnicum at Stuttgart, to the Minister of Commerce in Austria, to the Royal Italian Forest School at Vallombrosa and to the Department of Agriculture at Washington, U. S. Similar collections of correctly named specimens are also deposited in museums where existing, or in the offices of Conservators of Forests, in the different local Governments of British India. The opportunity has also been taken to forward to Messrs. Churchill and Sim, of London, a consignment of Indian woods, which seemed to merit notice in the London market, in order that the practical value of those woods for carriage-building, for furniture, for turning, and other works may be tested. The Inspector General of Forests points out, that the total number of species of trees in India amounts to about 2,000 of which barely 100 are extensively used or known to trade. Many of these woods, which are not now recognized as articles of trade and are little known, are very handsome and possess other valuable properties, and the object is to bring them to public notice.

* * *

IN connection with the rewooding of this country a correspondent of a Madras contemporary makes a suggestion that is worth consideration. He advocates the systematic establishment of nurseries "along roads, canals, railroads, telegraphic lines, *tahsil* stations, and at a thousand other points within easy reach of Government officers, from which seedlings could be supplied gratis to all applicants; and all Government officers, to render their supervision more effective, they should also be supplied gratis with a good hand-book on arboriculture." The writer proposes that Government should offer a reward for a good hand-book. That some such text book is required is amply proved by the following remarks in the Roorkee Paper *On Planting and Tending Trees*, in road avenues and topes in India.

"On many roads, nurseries existing at convenient intervals have originally been started by either transplanting very young seedlings, or by sowing, and the requirements of the avenues have been met from these plots by removing young plants as required at all stages of growth, and at any time of the year. As a rule, the plots are thickly sown, and the young plants packed closely together, lead a sickly existence, till roughly removed (without much regard to broken roots or age) and planted at the roadside in high *thallas*, where not unfrequently they wither away; this fate is shared by all but one of the 20 or 30 seedlings which replace them in succession, and this the last takes root owing to the lucky chance of having been planted at a favourable time, and to its being hardier than its departed kin; but its trials are by no means over, for the temperature of the water allowed to collect and stagnate in its mud prison-house *thallah* is raised to almost boiling point by the hot sun in July and August, and the plant dies. The process of replacing just described is again commenced and possibly repeated 50 times before some exceptionally fortunate, but badly selected seedling escapes these trials of infancy, and eventually for six months each year leads a leafless existence; useless, hideous and stunted—a monument of fruitless expenditure, neglect, and want of judgment."

There are a number of useful hints on the selection, planting and tending of trees in this paper—No. CCXLIV. of the second series of the *Professional Papers on Indian Engineering*.

* * *

IN connection with the denudation of our forests Mr. W. Bull writes to a contemporary as follows:—"It is quite clear that it is better to preserve a full sized tree which has taken, say, 25 years to come to its present state than even to plant another which will not answer any useful purpose until the greater portion of that period will have expired. These facts are so self-evident as to require no proof; and the subject being admittedly a very important one, I may be excused for asking you to assist me in making more generally known, by publication of this letter or any means you may think proper, a process which, if generally used, would lead to a very sensible decrease in the number of trees cut for brick-burning, for which purpose more are consumed than for any other. The following facts will serve to illustrate to what extent this consumption could be lessened. For every lakh of bricks burnt under the old system, forty large mango or other trees are required. For an Executive Engineer to require 100 lakhs of bricks for the length of canal or railway or large bridge in his charge, is a very common occurrence. For these 100 lakhs, 1,000 trees would be required. or sufficient to make an avenue along twenty miles of road. By using the process patented by me, this can at once be reduced from 30 to 40 per cent."

* * *

THE PETRIFIED FOREST OF CALIFORNIA.—The site of the petrified forest of California is about 1,000 feet above the sea level, and lies in the same trend with the Geysers, Mount St. Helena, and the thermal springs of Calistoga. A recent visitor says, that geologically it is one vast lava bed, in which the trees lie as they were thrown probably thousands of years ago by some convulsion of nature. The trees are in fragments, many of which have been converted into charcoal, others into lignite, and others into beautiful specimens of jet. Where the heart of the tree had decayed, the cavity is filled with opal, a form of hydrous, uncrystallized silica, containing water. Chalcedony, another form of the silica, but clear and limpid, is found in other cavities. No top has been petrified, and only here and there, a root.

* * *

LARGE PINE TREE.—The *Fond du Lac Reporter* gives the following demensions of a pine tree cut on the Wolf river last winter; it was sawn into six 16 feet logs, the first of which measured, inside bark, 5 feet in diameter at the butt and 4 feet at the small end, the second 3 feet 9 inches, at the small end, the third 3 feet 6 inches, the fourth 3 feet 3 inches, the fifth 3 feet, and the sixth 2 feet and 9 inches; the 6 logs scaling nearly 6,000 feet.

* * *

THE Government of India have recently addressed the Secretary of State regarding the selection of candidates for the Forest Service in India, their attention having apparently been drawn to the matter by the gradual falling away in the numbers of the candidates who annually present themselves for examination for admission to this service. One unsatisfactory result is derived from this state of things, namely, the necessity which exists with a small number of candidates, of being guided in selection, almost entirely by the number of marks obtained by the candidate under examination, to the exclusion of such important considerations as constitution, physique, habits, and modes of life, &c. To increase the number of candidates the Government of India think that no reasonable efforts should be spared. They believe that the most efficient remedy would be the improvement of the emoluments of the professionally educated officers of the department in India, and also the provision of better prospects of promotion than at present exist. They also suggest that the upper limit of age for admission to the service should be 22 years. This *inter alia* might have the effect of attracting to the Forest Service many of the men who fail for the Civil Service—men who have made up their minds for an Indian career and who would gladly avail themselves of the chance, which the raising of the limit of age afford them. They recommend that the examination papers should receive wide circulation in all English Schools and Universities, and they are of opinion that in view of the hardships, exposure, and disease incidental to the Forest Service in India, the medical examination should be as strict as possible and exclude all not possessed of really sound constitutions.

This condition, however, could obviously only be applied to the improved state of matters desired by Government under which a large number candidates would yearly present themselves for examination.

MR. GEORGE TAKADU, a Japanese gentleman belonging to the Agricultural Department, Japan, has been deputed by Sir Harry Parkes to visit the forest tracts of northern and southern India with a view among other things to make himself acquainted with Indian timbers. He has inspected the Dodabetta Cinchona Plantation, and been so good as to express great satisfaction with all he saw there. He registered a requisition for seeds of varieties of cinchona, to be sent to Japan.

THE Secretary of State has forwarded to the Government of India for distribution amongst the officers of the Forest Department, and in such other manner as may be thought desirable, 200 copies of a paper by Surgeon-General Balfour on "the influence exercised by trees on the climate and productiveness of the Peninsula of India."

A FOREST SCHOOL.

THE new Forest School to be started under the superintendence of Captain Bailey, will be the first organisation of its kind set on foot in this country. Hitherto the only system in force for training officers for service in the superior walks of forest life, has been carried on at Nancy in France. India thus remained dependent on Europe for the training of its foresters, though its own forests provided an ample field for the work Natives of India were unduly handicapped by this routine, though it has been considered desirable to employ them in all grades of the Forest Service. The establishment of an Indian Forest School has thus been looked upon for a long time past, as a desideratum, and was the subject of a minute by Sir Richard Temple, when that indefatigable officer was Lieutenant-Governor of Bengal. Now at last the Inspector-General has chosen the North-West Provinces as the scene of the new experiment; and the sanction of Government having been obtained, operations are to begin at once. At first the school will be merely employed in training candidates for the executive branch of the Service, though ultimately it is conceived probable that it will be concerned with the preparation of officers for the controlling branch likewise. It remains to be seen, whether the Governments of Madras and Bombay will follow the example thus set. Natives of India only will be admitted as students of the new school for the present. The forest divisions of Dehra Dun and Jaunsar in the Meerut division, and the leased forests of the Native State of Garhwal on the Tons and Jumna rivers, as well as a portion of the forests leased from the Bashahr State, will be attached to the school and put under the control of Captain Bailey, who will rank as an additional Conservator of Forests on a salary of Rs. 1,000 a month. Captain Bailey will assume charge of the forests assigned to the school, on the 1st of September next, but as it will not be possible by that date to organise the staff which it is proposed to form, students will not be received into the school till the 1st of June next. For some time to come it will be necessary, the Government believes, to encourage the school, by giving students advances of money under the authority of their local Governments or administrations to cover the cost of their education. Eight scholarships have also been sanctioned. These will be worth Rs. 120 a month in the aggregate; and they will be granted to any candidates who may be considered exceptionally promising. Eventually, however, it is intended that fees shall be charged for the instructions given in the school.

THE DECCAN FORESTS.

WE hear that Sir Richard Temple, in his recent excursions among the hills to verify by personal observation what he had heard of the destruction of forest trees by the hillmen near the sources of the rivers which water the Deccan, had much hard riding and climbing and exposure to bad weather, which he enjoyed amazingly. The ground at the source of the Moota river was found not to be quite so bare as had been anticipated, but that around the source of the Bhima is stripped clear of trees. The Bhils naturally prefer getting patches of ground to cultivate where the rivers rise, as they are thus always sure of getting water for their land. The Governor has no money we believe at his command to do much with in the way of planting forests again, but he may at all events prevent the mischief that has been going on from continuing to spread. We fear, however, that this will entail a great increase of the Forest Department, which is now far too weak to watch the whole of the hill country. In Khandeish, his Excellency will have the opportunity of ascertaining that a good many years ago Mr. Ashburner, then Collector of Khandeish, had the foresight to take precautions against the disforesting of the country, by having trees planted in all the Government plots of ground. Sir Richard Temple evidently did not know this fact when he wrote his Minute on Forests a few weeks ago, or he would with his usual generosity have hailed Mr. Ashburner as the precursor of that much greater prophet, Sir Richard himself.—*Bombay Gazette.*

The Planters' Gazette.

TEA.

THE Department of Agriculture of the United States are distributing in California tea plants, in lots of about ten to an individual.

THE Samples of Ceylon Tea sent to England are, we observe, very favourably reported upon. The *Produce Markets Review* says: "Some exceedingly fine samples of Ceylon tea have recently been sent to London, and if the general produce of the island come up to the high level of quality shown by these parcels, there can be little question of the success of the new industry. There is a sufficient supply of labour, and a considerable planting community who can readily look after the cultivation of tea in lands above the coffee zone. As compared with Assam, the saving in the cost of transport to the Coast would be of importance."

RED spider continues to do an immense amount of harm to tea plants in this district. The rains may perhaps, stop its ravages, but the injury done up to the middle of the present week by the insect is almost incalculable, as several gardens have, for practical purposes, been compelled to stop manufacture owing to the ravages of this mysterious insect. So far as can be gathered from information supplied us, and from our own observation, the "spider" is to be found equally on young and old bushes, on bushes growing in good and bad soil, on bushes that have been heavily plucked and in nurseries. But it appears to us that the spider does much more harm to stunted, over-plucked bushes than to healthy ones, and that his ravages above 3,000 feet of elevation are harmless compared to the damage he does at lower elevations. Somehow he seems to be languid and somewhat out of his latitude above 3,000 feet, and does not take so much out of the bushes. Heavily plucked (weakly) bushes seem, however, to suffer more than strong ones from the attacks of the "spider," and it is generally acknowledged that heavy and continuous rain exterminated the insect more or less. Whether this is merely a coincidence remains to be proved. That is, nobody apparently seems to know whether the rains, which begin about the middle of June, kill the spider, or whether the insect having by that time deposited ova and accomplished the end of its existence, dies out spontaneously. If this question could be solved, it might not be very difficult to find a means for at all events mitigating the ravages committed by it. The point to be attended to is, in our opinion, to nip the mischief in the bud; to ascertain when and where the eggs are laid, and to find out the cheapest and most expeditious means of killing both the parents and the ova at the same time. So far literally nothing of any practical value is known about the habits, growth, and propagation of an insect pest which has already done an incalculable amount of damage to the tea-plant in this district within the last few years.—*Darjeeling News.*

CURING IN BALTIMORE.

MESSRS. MARTIN GILLETT & CO., 70, Exchange Place, have received from Dr, Alexander M. Forster, Georgetown S. C. a quantity of cured tea raised by that gentleman on his farm at Georgetown. The tea is uncured and has the appearance of the leaves of the japonica. The leaves vary in size from one inch in length and under, to three inches.

They are extremely delicate looking, and have much the appearance of wax. Messrs. Gillet & Co. had the tea shipped to them with the intention of curing it, in the proper way, in order to produce an article of American growth that will support their assertion that tea culture in this country is not only feasible, but will be profitable to those who undertake it with a proper knowledge and experience in the matter.

The pickers of the tea received have fallen into the general mistake of plucking the large leaves in preference to the smaller, under the impression that they were obtaining the choicest leaves. The fact is, however, that the smaller leaves and sprigs are by far the best. Messrs. Gillett & Co., however, are confident of producing a good drinking article, and are now engaged in curing and drying the leaves.

The process of drying and curing is of sufficient interest to justify a brief description of it. The leaves are first taken and cleared of all foreign matter, the largest leaves are stripped off, and then are placed in a common sieve. The sieve is held over a pot of boiling water and the leaves steamed. The action of the steam makes the leaves limp, and prepares them for the next process. They are then taken up in handfuls and rubbed together, which curls up the edges and twists them up into small balls.

In this condition they become vary glutinous and stick together. After the rubbing they are placed in the sun or an oven, and under the action of the heat soon curl up into the small particles familiar to all tea-drinkers. Messrs. Gillet & Co. hope to have the tea cured in a day or two, and will then test it to see if it can be used for drinking purposes. If they succeed, it will be the first instance of the kind known.—*The Evening Bulletin, Baltimore.*

THE TEA TRADE OF JAPAN.

MR. FLOWERS, the British consul at Hiogo and Oraka, Japan, in his report on the trade of those ports for the year ended December 31, 1877, referring to the tea trade of Hiogo, says, that the export for 1877, shows an increase in value of 415,700 dols., representing an increase in quantity of 2,956,048lbs. The total quantity exported was 9,426,672lbs., of the value of 1,929,784 dols. America took 8,257,997lbs. while the export to London was only 55,515lbs. The export of tea from Hiogo has steadily grown during the last nine years. In the season 1869-1870 the quantity exported was 2 735,134lbs.; in 1866-77 it was 6 989,223lbs. It is evident (Mr. Flowers says) that Japan teas are holding their own in the United States, as the consumption there for the past year shows an increase of nearly 3,000,000lbs. on that of the proceeding year. The consumption of China green teas, on the other hand, is decreasing. Whether Japan teas will long continue to hold this superiority is, however, a question for the future. The tea trade this past year has, I believe, been on the whole tolerably remunerative to foreign merchants. Prices during the season kept fairly steady, and showed no violent fluctuations. Although prices gradually declined as the season advanced, the expectation of the imposition of a duty on tea in America prevented a further decline. The supplies of new leaf arriving on the market in May were rather unusually large, and though these were settled at low prices as compared with previous seasons, they were hurried forward in such considerable quantities that their arrival upon the American market produced a depression and consequent loss. The market there, however recovered later on, and a large proportion of the latter shipments resulted favourably. Prices generally throughout the year showed a further decline as compared with previous years. Speaking of the efforts which are being made to stimulate this important native industry by the manufacture of black tea, Mr. Flowers says —"It is of the greatest importance to this country, in view of the strong competition which exists between Japan teas and Formosa Oolongs in the only great market for both these kinds of tea—namely, America—which has had the effect of gradually reducing prices, and thus imposing a limit upon production that she would be enabled to find some new outlet for her teas. It is with the object, therefore, of producing a higher class of tea, which will find a ready market in England and other countries, that the present experiment is being conducted. Several hundred pieces of imitation Congou were shipped to London in the course of last year, and I believe that they were favourably received in that market. It is yet early to form any reliable conclusions as to the ultimate success of this undertaking. but I understand that specimens of the tea thus manufactured have on examination been found to be of high quality and good flavour, and that the only question which has to be decided is whether these teas can be produced at prices low enough to enable them to compete favourably in foreign markets with China and Assam teas."—*Colonial Empire.*

BROKEN TEAS.

LOOKING at recent reports of tea sales in the home market, the large lots which are put down under the class of "broken tea" strikes us as being an unduly large proportion of shipments. It may be useful to notice one of the causes which produce such large percentages of "broken tea." The foremost causes lies, we believe, in the indifferent method sometimes followed in sifting and sorting. On some estates the wire sieves of proper gauges are entirely discarded in favour of the more primitive bamboo concern, which latter has a most irregular series of vents, becoming still more irregular as the shifting of the split bamboo plaits is facilitated by the handling which both the tea and the sieve undergo during the process of sifting.

It is no uncommon thing upon those estates which favour the indigenous "machine" to see a cooly sitting on his haunches, holding up one of these sieves and shaking through it all the tea that will fall through without pressure. This quality is often called Gunpowder, and subsequently is taken in hand by a number of women who go in for the use of the common kitchen rice sieve, and is separated from the Dust tea. Then follows another cooly squatted next to the Gunpowder man, from whose sieve is tossed over the whole of the tea which remains behind in the first sieve. The business of cooly No. 2 is to shake through his sieve all that will come through without pressure, but with the least bit of squeezing between the palms of the cooly's hands. It is worth while noticing that if cooly No 2 were using the wire sieve of the proper guage, he would all the time be able to sort Flowery pekoe, but he doesn't with the bamboo sieve, and the next best thing he is able to do is to produce a quality akin to Orange pekoe, and so it is called. This second cooly passes the contents of his sieve on to another cooly, whose business it is to get as much through his sieve as he can, both by shaking his sieve and by alternating the shaking with a considerable amount of hand rubbing intended to force through the sieve all that it is possible to call Pekoe souchong. Whatever tea cannot be passed through the last sieve is then called Congou.

Congou tea may also be made to represent a higher quality by de[illegible]ous admixture with Souchong and often with Pekoe souchong, not so dexterous, however, that it can manage to elude the discernment of canny brokers and professed tea-tasters. In making such a mixture the Congou is fired a little so as to make the leaf as brittle as possible without burning. Indeed, although much precaution is taken, a second firing unless it is simply to warm, prior to packing, can only end in burning. Hence the word "burnt" so freqently found in brokers' reports. When the tea is quite crisp it is squeezed and rubbed until its size and any curl that it possessed are both done away with, and it remains a little better than dust tea. No broker in the world could thereafter certify that that was or had been Congou!

It is a great pity that such a mixture should be made, because if Congou sailed under true colours it would really fetch a better price than the often misnamed Souchong and Pekoe souchong, which are neither one thing nor the other, do not possess the amount of curl which is necessary to constitute the quality aspired to, are not calculated to win the confidence of trade in descriptive advertisements or inaccurate invoices—for brokers and buyers will break bulk and will satisfy themselves by sampling that the class is really what it is stated to be,—and the loss which accrues to shippers on such consignments, together with the consequent discouragement which it produces, is certainly not the least a help in the competition which is springing up between Indian and China Teas.

THE FUTURE OF TEA IN INDIA.

AS the tea enterprise is now beginning to attract speculators in South India, it will not be uninteresting to say a few words regarding its early history. We have, therefore, gleaned a few particulars on the subject which may be relied on. Dr. Royle in 1827, pointed out that tea might be successfully grown in the north-western portion of the Himalaya districts. He indicated Kumaon as well suited for the culture. In 1834, during the time of Lord William Bentinck, seeds and plants were brought from China, nurseries were formed in Calcutta, and plants despatched to Kumaon, and the Hill districts of Madras. In the meantime it had been discovered that the plant was growing in a wild state in Assam. Experiments were consequently made by Government in the Province. It was found that the greatest success in culture was attained on "hilly slopes" or in "the vicinity of rivers," with a temperature not ranging beyond 80°. Experimental parcels of tea were sent to England, and realised very high prices there. This placed beyond a doubt the profitable nature of tea-cultivation in Assam. Speculating individuals, whose attention was drawn to the fact, formed themselves into a company for the purpose of cultivating the plant in that Province. To this Company, the East India Company, having creditably enacted their part as the pioneers of a new and valuable branch of enterprise, handed over in 1839, their experimental plantations and establishments. The "Assam Company" had to encounter in the beginning many difficulties. Labour was deficient, and their managers were wanting in skill. Their property was remote from supervision. But perseverance overcame all these obstacles. In 1853 their plantation embraced 1,200 acres of land, and yielded a crop of 300,000lbs. of tea. In 1855 the crop was 588,379lbs.; in 1856 it was 638,789lbs, in 1857 it reached 700,000 lbs., and in 1860 we find the shares of the company originally priced at Rs. 200 selling at Rs. 31[illegible]

In Madras, as we have remarked in previous articles, tea-culture has not made as much advance as might have been expected; but it is pleasing to note that several new tea gardens have sprung up in Coonoor within the past twelve months, and that interest in the enterprise seems to have been awakened at last.

So many lengthy essays on tea-culture have been written that it may, perhaps, be considered superfluous were we to enter into details of the method of cultivation. But we are sure young tea-planters will be glad of a few practical remarks on the subject, and we, therefore, give briefly Mr. Fortune's system. Cultivators must make it their first object to acquire a knowledge of the plant. They must also be careful as to the land which they select for a plantation. Tea requires a good sound soil a light loam, well mixed with sand and vegetable matter, moderately moist, and yet not stagnant or sour. The seeds to raise the young plants are gathered in the month of October and kept mixed with sand and water during the winter months until spring. They are then sown thickly in the nursery, and transplanted when a year old, and nine inches to a foot in height. In the new soil they are placed in rows about four feet apart. The picking is a very delicate and important business. During the first two or three years the leading shoots only should be lopped, in order to form the plants, and make them bushy. If too many leaves are annually taken from the trees, they will soon become sickly, stunted and covered with dead branches. In China, we read, even children know how to pick in the right way, and the object to be kept steadily in view is to obtain as large a quantity of leaves as the bushes are capable of yielding, *not in any given year, but during the whole period of their existence.* With regard to the preparation of the leaves, the following is a summary of the process:—1st, when they are brought in from the plantation they are allowed to lie for some time spread out in the factory after being gathered, and before they are roasted. 2nd, they are then tossed about until they become soft and flaccid, and then left in heaps: an operation which is repeated before they are roasted; 3rd. after being roasted for a few minutes and rolled, they are exposed to the air in a soft and moist state and 4th, they are dried slowly over charcoal fires.

In conclusion we can only say that there is a bright future for the tea-enterprise in South India, and we trust to see more venture in it than has as yet been essayed.—*Madras Times.*

IN CEYLON.

THE proprietor of Barra Estate in Ceylon has sent the following information to the *Ceylon Observer*.

" Anything which throws light on the prospects of tea planting in Ceylon will no doubt be acceptable to those interested in the question.

" I therefore subjoin reports and valuations on ordinary samples of the Barra Estate tea, which were sent home a few months ago. There appears to be no doubt now, that in suitable localities tea in Ceylon will flush all the year.

" On the Barra Estate picking commenced for the first time on the 15th October. In that month the coolies picked for 7 days, in November for 16, in December for 15. From that time until the end of May picking took place on 23 days in each month.

" The point now to be ascertained is the yield per acre. For the moment this cannot be accurately known, as the exact acreage of the land in full bearing is not known; the superintendent estimates it at 350lbs. of merchantable tea for this year, picking nothing below Pekoe Souchong. So far the picking is at the rate of 200lbs. per acre on the total estimated acreage."

Appended are the following reports :—

Report dated 10th April 1878.
Barra Estate, Rukwana.

Orange Pekoe.—Small black curled leaf, good gold tip, flavory tea, but lacks strength, value 2*s.* 6*d.* to 2*s.* 7*d.* per lb.

Pekoe Souchong.—Rather bold, blackish Pekoe souchong leaf, fair tip, soft liquoring tea, rather thin, value 1*s.* 10*d.*

Broken Orange Pekoe.—Small blackish even curled leaf, good gold tip, flavory tea, rather strong, value, 2*s.* 7*d.* to 2*s.* 8*d.* per lb.

The above teas are very well made, and the appearance is very fine, but the liquor is deficient in strength and pungency.

May 17. ——— takes great interest in your tea samples and says the tea is well made, and though there is a prejudice amongst dealers against Ceylon, one of the leading men valued your samples as follows :—

Barra Estate Pekoe	2*s.* 4*d.* per lb.
Pekoe Souchong	1*s.* 4*d.* ,,
Fine Pekoe dust	2*s.* 6*d.* to 2*s.* 8*d.*

May 23. ——— says they are young, without a blemish, and of undoubtedly fine quality, both in flavor and strength, and with a little more care in manipulation would run the best of the Indian teas very hard.

The great depression in the tea market generally will account for the value put upon them not being higher.

The *Observer* remarks :—

" Reports like the above, which are now crowding in upon us, form the best answer to a remark in an article on tea growing in India, in the *Tea Gazette,* to the effect that experiments are being made in Ceylon but that their success has yet to be proved. We look on success as beyond all possible doubt. The valuations made are exceedingly good considering the state of the home market and the imperfect appliances with which samples are as yet prepared in the island. This and imperfect packing may have raised a prejudice in the minds of some who may have received deteriorated samples, but the time is rapidly advancing when Ceylon tea will take its place in the London market with the very best leaf from India. We trust, however, that quality will never be sacrificed to quantity, as appears to have been the case, and with such disastrous results, in some parts of India.

" Barra is low-lying and warm, the elevation being only about 1,800 feet above sea-level. But, even so, flushes succeeding each other continuously for nearly six months form a remarkable phenomenon. Of course, such constant and copious flushes cannot be expected at very high elevations, but we know that tea is giving satisfactory and most promising results in Dimbula at 5,000 and even 6,000 feet altitude.

* * * * " The letter of our correspondent is interesting as giving an approximate estimate of quantity per acre. A yield of 350lbs. of really good leaf per acre would pay very well. But in favourable situations, where the soil is rich, the climate good, and facilities for manuring present, this average may be largely exceeded. Small gardens in Chittagong, heavily manured, yielded over 1,000lbs. to the acre. As yet, and even after railways are made to the foot of the Darjeeling range and into the alluvials of Assam, tea planters in Ceylon will be better situated as regards the important item of manure.

* * * *

Our only disadvantage is a soil not generally rich. Some would add the steep features of much of our hill forest land. As to this we can only say that we walked over portions of Singell and Castleton, two adjoining estates, at Kurseong (*Darjeeling*), which gave good dividends even last year, and that we had to encounter ups and downs as steep as any in Ceylon. On another estate, reckoned amongst the best in the Darjeeling District, the elevation of the top part of the estate was over 5,000 feet altitude (in 28° north) while the river which formed the lower boundary was only 1,700 feet above sea level. We do not say that very steep features are desirable—wash is a great evil (which terracing much alleviates in India)—but there is often compensation in good natural drainage. As we have mentioned terracing, we may add our opinion that, expensive as the process is, the time has come for resorting to it in Ceylon, to a large extent, in the case of coffee as well as of tea. There are difficulties to be encountered doubtless, but there are counterbalancing advantages. We shall never forget the impression made on us by the garden-like appearance of Geille tea estate with its clean curving rows of terraces following the contour of each hill ravine and valley. The rice terraces in the Dekanda valley as seen from the railway incline will give an idea of what we saw. Only that the tea estate terraces were narrower and far more regular, with the trees planted closely in them. On one estate in Darjeeling we saw the plants (China in this case) planted in rows only 18 inches apart and only 12 inches apart in the rows. We saw the contrast of some of the earliest planting, 8 by 8. The result of all we saw and heard was to lead us to adopt 3 by 3 for best hybrid Assam at an elevation of 4,500 to 6,300 feet. At elevations like that of Barra, probably 4 by 4 or even 5 by 5 might be adopted with advantage. In the Darjeeling Terai 5 by 5 or even 5 by 6 is not too wide, for on one estate there we saw a magnificent vase-like plant which measured 4 feet in diameter, giving 12 feet for circumference. We saw nothing like this again until we visited Prospect Estate on the Nilgiris. A tree (a pruned bush rather) we measured there was 3 feet in diameter, or 9 feet circumference. At low elevations—perhaps at high, with good cultivation—we have no doubt similar results may be here obtained "

NOTES ON MATE OR PARAGUAY TEA.

DR. H. BYASSON, having been requested by Professor Gubler to examine a specimen of " Maté " or " Paraguay tea," has recently presented to the Paris Academy of Medicine a note containing a *résumé* of the principal facts previously known respecting this product, together with some observations as to its chemical composition. The following is an abstract of this note :—

The leaves are collected every two or three years, that interval being required for them to attain their growth: the branches are cut off with their leaves, and they are dried altogether over a large fire. The leaves are then detached, sorted, and placed in large baskets, where their drying is finished. After about a month the leaves are powdered, and are then ready for the market. An infusion of the tea is prepared in a kind of cup (*mate*), made frequently of a calabash mounted with silver. Some persons add to the beverage a little burnt sugar or a few drops of lemon-juice. The liquid is sucked up through a tube, called a " bombilla," at the lower part of which are several small holes, which do not allow the passage of the fragments of leaf. The leaves can be used three times, but the infusion alters rapidly. After some qualitative experiments, M. Byasson proceeded with the analysis as follows: 100 grams of *maté* were intimately mixed into a paste with 25 grams of slaked lime, and the mixture was dried slowly in a stove at 75° c. It was then exhausted successively with (1) 600 c. c. of chloroform; (2) 600 c. c. of 90° alcohol; and (3) sufficient distilled water to remove the alcohol as much as possible. The chloroform solution, of a green colour, was distilled; the dried residue, which was brown and contained crystalline needles visible to the naked eye, was treated several times with distilled water, upon slow evaporation of which a yellowish white substance was obtained, that re-dissolved in alcohol, gave after evaporation and cooling, a nearly white crystalline mass. Previous experiments had indicated that this was caffeine, and the product was sublimed to obtain a better crystallisation. The caffeine obtained from the 100 grams of maté weighed, after crystallisation from alcohol, 1·850 gram; after sublimation, 1·734 gram, a small quantity being destroyed by sublimation.

The residue from which the caffeine had been extracted was dried over sulphuric acid. It formed a greenish-brown substance, resembling in consistence the birdlime extracted from the common holly, but less elastic and darker in colour. This glutinous substance dissolves in all proportions in ether; it becomes nearly liquid at 80°, and it burns with a white fuliginous flame. Strong solution of potash attacks it with difficulty. Attempts to purify it and determine its chemical character were not successful on account of the small quantity operated upon, and especially the difficulty in removing the green coloring matter, with which it was impregnated. The following experiment indicates that it must be considered to be a fatty body or compound ether, the alcohol of which would be near to cholesterine. Two grams were submitted to the prolonged action of a hot alcoholic solution of potash, care being taken to replace the alcohol evaporated. After two hours the glutinous matter appeared to be completely transformed, and yellowish white flocks floated in the liquor. The alcohol having been driven off by evaporation, and the residue taken up with ether, the ethereal solution left upon the evaporation a nearly white substance in crystalline scales, resembling, but without being identical with those of cholesterine. The portion insoluble in ether, treated with water acidulated with hydrochloric acid, gave a white fusible substance, soluble in alcohol and in alkaline solutions.

The alcoholic liquor, which was of a slightly greenish-yellow colour, was distilled to remove the alcohol, and the residue treated with distilled water. A yellowish-white substance that floated to the surface of the liquid was separated on a filter, washed with water, and re-dissolved in absolute alcohol. It presented all the characters of a resin; it had neither taste nor odour, and by dry heating it yielded a spongy charcoal, and a small quantity of brown acid liquid having an acid taste. The evaporation of the water left a substance difficult to dry completely, and not showing any trace of crystals. Again treated with absolute alcohol it dissolved completely. The alcohol deposited an amorphous substance, nearly white, with an aromatic odour recalling that of the plant and a scarcely acid reaction, but presenting none of the characters attributed to caffetannic acid and noticed in mate by Rocheleder. Caffetannic acid was also sought for by precipitating an aqueous infusion of maté with acetate of lead, but the result was negative. The preceding substance boiled in water slightly acidulated with sulphuric acid, developed the markedly aromatic odour of the plant, whilst the solution reduced the cupropotassic liquor freely. After some hours it became strongly coloured, and deposited brown flocks. The aqueous infusion of 100 grams of maté slightly acidulated with sulphuric acid, heated and then decolorised by acetate of lead, was dextrogyre. These characters proved that the substance isolated was a complex glucoside, the decomposition of which yielded glucose and a compound to which the plant owes its characteristic odour. A hundred grams of maté exhausted by a litre of boiling distilled water yielded 24 grams of dry extract. The precipitate produced in aqueous infusions by basic lead acetate was washed with cold water and redissolved in boiling water. The filtered solution deposited upon cooling slender crystals of a salt presenting all the characters of malate of lead: particularly those of fusion and of yielding a pitchy mass by the action of a quantity of water insufficient to dissolve it. The tests for tannin gave negative results. Incineration of the extract yielded a proportion of ash equal to 3·92 per cent. of the maté used. The ash contained carbonate of potash; it was rich in sulphuric acid, and iron was present in weighable quantity. The 100 grams of mate yielded—Caffeine, 1·850 gram; glutinous substance, or peculiar fatty matter and colouring matter, 3 870; complex glucoside, 2·380; resin, 0·630, inorganic salts, including iron, 3 920; malic acid, not estimated. The relative proportions of caffeine or theine contained in different sorts of coffee or tea (*Thea Chinensis*) determined by Stenhouse amounted to 1·37 per cent. in the richest tea, 0 20 per cent. in coffee, and a still smaller proportion in mate. These figures do not agree with those obtained by Robinquet, Payen, and Mulder, and agreement is scarcely possible with specimens from different sources analysed by different methods. But Paraguay tea analysed by the author as described contained an amount of caffeine comparable with that in the kinds of coffee and tea richest in that alkaloid.

COFFEE.

IN THE WYNAAD.

WRITING to a Madras paper on the 21st June, a correspondent in the Wynaad says:—Grass knifing is in full force; and that, and the handling out of the trees, make the estates look much better. Of course, heavy momaty work is out of the question, as the rains would only make ghastly landslips of the loosened soil. I am sorry to see signs of the old enemy, leaf disease, which I suppose will, as usual, become horribly visible directly after the monsoon. It is curious to notice how here and there some tree appears to be an especial sufferer, and to get the disease badly whether the rest of the field be equally afflicted or not, and how such a tree is invariably the first to show signs of what is coming by the color of its leaves, even before the others are apparently affected. It seems as if even coffee trees had "confirmed invalids" in their communities. The berries are swelling fast, and most people, I fancy, can by this time form a pretty fair estimate of their coming crop, and many, I fear, groan in the spirit as they make their daily rounds over fields that promised so wonderfully at blossoming time, and now fulfil what is becoming amongst us a time-honoured routine, namely, disappointment. I think there was a sort of general feeling at the beginning of this year that things had arrived at their worst, and that a very considerable change for the better must be in store for us; and we actually began to recall the nearly forgotten word "bumper," so that to find that, after all, our crops must range this year once again in the order of "very bad' many, "medium" few, and, "really good"—to count by units, is a very keen disappointment, and enough to damp the hopefulness of the most sanguine amongst us.

THE LEAF DISEASE ON COFFEE TREES IN INDIA AND CEYLON.

BEFORE entering upon the subject of so great interest to the coffee planters, *viz.*, the "Leaf disease"—the following narration will show how I was brought face to face with "Leaf disease" on coffee trees, and the necessity of my having studied what it was.

Having been assured by several persons that plenty of money could be made by coffee-planting in Travancore, I thought of making money, and plenty if possible, but I have made none up to date, for reasons which will be perceived from the following.

My estate was opened and planted in the good old fashion,—good drain, good holes of 18 inches by 18 inches, and 18 inches in depth, etc., etc. but after 3½ years I found I was greatly deceived, and I was so disgusted that I was about to sell out my estate, if possible, and if not to abandon it (100 acres planted).

Like the other estates, in general, my estate, is situated on steep land, and after the heavy rains of the next monsoon alone, the humus of my land was washed away entirely, and the heavy rains of the next monsoon carried away the best arable good soil of the land, and then there were signs of the "Leaf disease" on my trees. At once I made an expensive thatching of Rs. 3,700 over 100 acres of my plantation so as to protect the remaining arable soil against wash, and also with the view of forming some new humus. My thatching made with grass hill was 8 inches thick, and did good service to the trees at first; and after six months, when the thatching was half rotten and reduced from 8 inches to 3 inches, I was quite satisfied that my trees were getting on well, but unfortunately the monsoon came in, and in a very severe unusual way, and my expensive new humus thatching was carried away; but fortunately I had made 360 rain-holes per acre, of 2 feet by 2 feet and 18 inches in depth, and these 360 rain-holes per acre did receive a great part of the wash of the humus thatching and the remaining good soil, and after the monsoon all my 300 rain-holes per acre on such steep land were nearly full. I was about opening 360 new rain-holes per acre, when it struck me that all these troublesome and extra expensive works were of no use, because I was unable, on such steep land, to apply to my cultivation the first fundamental rule of agriculture, *viz.*, the loosening and turning up of the arable soil of my plantation often. After some serious consideration I wrote to the planting community of Ceylon and India about the necessity of advertising a grand public competition for the best new *modus operandi* for the steep lands of India and Ceylon. Measures not having been taken by the planting community, so as to secure the best *modus operandi*, I began my own studies and experiments, and, after a great deal of trouble of all sorts, I have succeeded at last in composing the new combination by which such an immense object is gained fully for steep lands, not only for new future openings, but also for the existing plantations of coffee, or cinchona, or tea, or cocoa.

Of course, as it is not man but men together who make combination or invention perfect, I consulted all the scientific practical men belonging to the Institute* of which I have the honour of being a member since 1844, and a Professor since 1866, and their assistance has been of immense value and great encouragement to me, because I discovered that I would save from certain ruin not only my own estate of 100 acres, but save also from ruin or deception a great many European British Planters settled on the steep lands of Ceylon and India. Indeed, it is painful to see Europeans invest their capital and spend the best years of their life in a tropical climate, and meet with deception and often with ruin, instead of making profits and a fortune well deserved.

Therefore, for new opinions to be made on the steep lands of India and Ceylon, I guarantee a full and complete financial success. New openings are for the future, but for the present there are perhaps 400,000 acres of land, or more, of existing plantations in India and Ceylon, and such immense capital will be not only saved, but rendered a valuable investment, if the planters pay full attention to the practical works to be carried out for existing plantations on steep-lands, and visit Trevandrum to see with their own eyes and judge by themselves, and for themselves.

Now I come to the very difficult subject of "leaf disease." But, indeed, is it a very difficult subject? Not at all! It is a very simple subject by itself, but the studies made on the subject are indeed, great studies, as will be seen.

1st. Our Powerful and Eternal Master, God, in making the day and the night, did so particularly for the vegetable kingdom. Under the tropical climate of India and Ceylon (and all the other tropical countries) we have constant vegetation all the year round and without interruption, and therefore our tropical culture requires constant care (and our present care is incomplete).

2nd. It is precisely during the day, when the heat of the sun is powerful, that Divine powerful nature has made endosmose to act, so as to furnish sap to the trees, branches and leaves, so as to protect particularly the leaves against the heat of the sun (heat necessary to vegetation in certain proportion, but injurious when it exceeds much that required proportion).

3rd. The powerful moderator, made by Nature itself, against an excess of heat is the humus which is at the very surface of the land! ...... Not only such humus is a powerful moderator against the heat (under a tropical climate) but the humus is the richest part composing the soil, and therefore for these two reasons when the humus of the soil is lost entirely (under a tropical climate particularly) we are subject to agricultural deception and hence financial deception.

4th. Notwithstanding the powerful endosmose the hot air from one side, and the hot soil from the other side (besides the hot sun itself) affect the results of the endosmose, and hence we see often our coffee leaves hanging down in a miserable condition, and if such was to continue (by supposition of course), without interruption during 240 consecutive hours, I am certain that all the coffee-plantations of India and Ceylon would die entirely.

5. But Divine powerful nature has made the night, and hence great relief to the trees and leaves, because the hot air, the hot soil, the sun itself at sunset begin to be temperated gently, but not suddenly, and hence we have damp air, cold soil, atmospheric condensation producing dew, and thus begins the process inverse to endosmose, namely, the exosmose, and it is by the abundant respiration of the leaves, that the damp air, the dew of every night (more or less according to atmospheric circumstances) is brought back to the branches, trunk and roots of the tree for a provision for the coming hot day.

6. Besides that provision furnished to the soil by the work of exosmose, the soil itself would absorb much of the humidity of the air and dew, if it was well loosened, deeply and in a friable condition; but unfortunately, the soil on the steep lands of India and Ceylon is kept hard, unloosened and not at all kept in a friable condition as required in agriculture. But the absorption by the soil will be still far greater, every night, if the loosened and turned-up soil contained the humus of the soil (the produce

of the vegetable decomposition of many centuries). But unfortunately there is no humus left at all on the steep lands of India and Ceylon, and besides there is no possibility of loosening the soil deeply and turning it often (for instance every time a weeding operation is required,) because by such loosening and turning up of the soil, such friable soil will be carried away by the rains, the monsoons; hence the fatal necessity of keeping the soil quietly and naturally as it is, and satisfy ourselves by pulling out the weeds by hands, or by using some sort of scrapers invented 4,000 years ago, and thus avoiding loosening the soil and turning it up particularly.

Well, is that agriculture? Not at all; it is a monster piece of nonsense, because it is opposed to agriculture and nature. In consequence of such nonsense, expensive and abundant manure is then used, so as to remedy partly the nonsense, but full success is never obtained by such expensive remedy. Indeed there is the opinion of the greatest masters in modern agriculture (English, French, German, Dutch, Belgians, Americans), *viz.*, "Le sol le mieux amendé, *le plus richement fumé,* repondrait fort mal aux espérances du cultivateur; s'il n'etait convenablement *faconné,* pour recevoir *tous les cleéments* qui lui sont nèccessaries"; indeed, how is it possible on hard steep lands to *aconner* the arable soil, without a special process of combination?

When the soil is hard, not loosened and turned up often, the atmospheric gases cannot act in the nourishment of a wonderful productive plant like coffee. In the present condition of the existing coffee estates, the first fundamental rule of agriculture cannot be applied, and hence miseries, deception attending coffee-planting in general, notwithstanding expensive heavy manuring.

Well, I have explained endosmose and exosmose acting during the day and the night, and such alternatives taking place every day and every night, we must now consider fully in what condition we are then on the steep lands of hilly countries situated under the tropical sun of India and Ceylon, *viz.*,

(*a*) Soil unprotected against the heat of the sun on account of the entire loss of the humus of the soil.

(*b*) Soil having lost, besides humus, its richest arable part.

(*c*) Soil unable to absorb the humid air of every night.

(*d*) Soil unable to absorb the atmospheric gases so necessary to the nutrition of the trees.

(*e*) Soil unable to retain the precious rain which falls on its own surface. And in such condition of agriculture, can we unjustly attribute our miseries and deception to the leaves and call the blunder "Leaf-disease?" Can we? No, I say positively no! The sickness affects the leaves because the sickness originates from all the causes I have already mentioned above. But to these serious causes, there are again some other complicated causes which I shall explain in my next, and I am fully certain that all the scientific agriculturists and botanists of the world will fully agree with me and be of my opinion, *viz.*, that, with the present condition of agriculture on the steep lands of Ceylon and India, it is strange that we have not yet got something more than "leaf disease!" But the burial of all our coffee undertakings—Of course the burial has been avoided by expensive manuring, but manure in agriculture is only one part of its numerous processes, and a most incomplete part of the points mentioned in (a) (b) (c) (d) (e) are not obtained fully.

On the steep lands of the hilly countries of Ceylon and India, the tap roots of the coffee trees are unable to perform freely their due share in the act of endosmose, because the natural growth of the tap-roots is paralysed entirely in its depth by the hardness of the sub-soil on the steep lands of mountains. This is a serious matter, because during the dry weather, if the drought is prolonged much more than usual, the surface roots (lateral roots) having no moisture from the upper-soil itself, and besides the soil itself absorbing no moisture afforded by the damp air, the dew of every night (on account of the hardness of the soil,) the surface roots are unable to assist much in the act of endosmose. In such circumstance of a prolonged drought, it is only the death of the tap-roots on which depends much the work of endosmose, and for this reason it is of vital importance that not only nothing should prevent or obstruct the natural extension of the tap-root, but that we must combine so as to induce the tap-roots to go artificially much more in depth, and as much as possible. It is one of the points in my new combined methods specially for the steep lands of India and Ceylon. The point is indeed of importance, because during a prolonged dry weather it is the tap-roots alone, in some cases, which furnish the amount of damp required for the work of endosmose. During the rainy weather, it is true that the surface roots are able to produce endosmose by themselves, but even in that case, endosmose will be incomplete without the concurrence of the tap-roots. Why so? Here, Mr. Editor, is the most important scientific observation with which we have to deal now, *viz*:—Because it is the tap-roots in coffee trees (as well as in other trees) which furnish principally the damp solution necessary to endosmose, but as the silicates, oxides, salts of the sub-soil, are not similar to the silicates, oxides and salts of the surface arable soil, a mixed combination of both (tap-roots and lateral roots) is necessary.

Indeed, the tap-roots by their depth cannot be in direct contact with the atmospheric air and its gases, and for that very reason Divine Nature has made lateral-roots (surface-roots), so as to allow to the surface-roots the faculty of bringing in the endosmosic solution, the required atmospheric gases necessary to the sap of the tree, and indeed sap is required in great quantity as also in its quality, and that quality is bad if the lateral-roots are unable to absorb the atmospheric gases, so as to bring them in the endosmosic solution. Of course a good quantity of sap is required, when the trees are loaded with plenty of branches, leaves and fruits (cherries,) but we must not obstruct, as we do, its quality.

Indeed, in the present agricultural condition of planting on the steep lands of the hilly countries of India and Ceylon, the work of endosmose is thus entirely incomplete in quality, and during dry weather incomplete in quantity and quality, and hence the trees suffer much during the long days of hot and dry weather, and when during the nights exosmose takes place by the injured leaves (the injury being done to the leaves every day by the prolongation of the windy hot air, the hot soil, the worst of all things, the hot sun and drought,) the injured leaves are then unable to absorb abundantly the amount of damp afforded to them during the nights, so as to bring back to the branches, trunk and roots of the tree the quantity of exosmosic liquid urgently required as an equilibrium between the work of aspiration and the work of respiration necessary to vegetable existence, and which work has been called by the *savant* Dutrochet, endosmose and exosmose Under such conditions sickness begins in the general constitution of the tree. Here, Mr. Editor, ends the whole question, and every man of good sense and intellect, and particularly a chemical agriculturist and chemical-botanist will see at once that such sickness is not caused at all by the leaves themselves directly, but caused by the improper and very incomplete work of endosmose and exosmose, both in quantity and qality. Re-establish fully and freely the work of endosmose and exosmose, the tree will be, then in full condition of vegetable life. It is that full condition of vegetable life that I have secured by my new combined method for the planters established on steep land, if they are willing to try the method and follow instructions to the letter. It is necessary to state here that, according to the law of English patent, a long detailed specification is not allowed, but the specification must be as short as possible and to the very point. This is exactly what I have done in my full specification, and thorfore all the agricultural instructions required are not at all mentioned in the specification. That is the reason why my instructions should be followed fully to secure full success.

For the existing plantations the object of the combined method is, *viz.*—

(*a*) to form new humus artificially progressively, but as quick as possible, (so as to compensate the loss of the natural humus of the soil, which has been washed away entirely by the heavy rains of the monsoon) and protect entirely that new humus, artificially made, from being washed away in any way.

(*b*) to secure entirely the rainfall to every tree of a plantation.

(*c*) to be in a position to move deeply and freely the soil of a plantation, to turn it up here and there often, so as to enrich mechanically and chemically the arable soil, by its contact with the atmospheric gases, and this without any danger of the well-loosened soil, manure and humus from being washed away by the rains of the monsoons.

(*d*) To allow full vitality to the lateral roots of the tree (of existing plantations), to spread freely in every direction, and to help the tap-roots in every possible way, as indicated in the specification of the new method, and under such conditions as mentioned shortly in (a)(b)(c) and (d) we shall secure far greater endosmose and exosmose to the trees (coffee, cinchona, tea, cocoa, etc) both in quantity and quality of the endosmosic sap, thus avoiding all the annoyance to which we are subject, called "Leaf disease"—and thus be in a position of making money—instead of losing money and time For new plantations to be opened I refer the interested parties to my full specification of the method and to my circular proposal to the Planters of India and Ceylon, and for such new openings I guarantee a wonderful financial success.

I have published in my circular the opinion of two eminent scientific practical gentlemen from Brazil and Cuba. I was in a position to publish also similar opinions from scientific practical gentlemen from Java, Louisiana, Réunion, but I had no space left in my circular, so I did not publish these opinions, but as in Travancore we have a well-learned scientific amateur agriculturist, already well known in India to several scientific gentlemen, allow me please, Mr. Editor, to quote the opinion of that learned scientific amateur agriculturist:—

"Mr. A. Montclar has kindly shown me the specification of his improved mode of planting and cultivating coffee and other productive plants in our mountain lands. I have read the paper with care and with much interest.

"I believe that the points mainly aimed at in the proposed mode of cultivation, and wherein it differs from what now generally obtain are: 1st, the complete preservation of the decaying vegetable mould, as far as may be found to exist and may continue to turn up, and secondly, the storage of the precious water which the periodical rains pour forth but which, instead of fertilising the soil, not only runs waste, but washes away, humus, soil, manure and all in its headlong course.

"The importance of these two objects needs no comment. The organic matter which decaying vegetable mould returns, as it were, to the mother earth, is the most abundant and easily available of all replenishing means. A very large percentage of this rich material is entirely lost under the present system of reckless felling and burning—even what is left in the shape of ashes being washed away on the *debut* of the monsoon.

"Mr. Montclar's method aims at conserving it. So again the new plan by the improved formation of sufficiently large and deep pits, with walling of earth constructed in accordance with the lay of the ground, and by proper drainages to carry off the surplus of water, appears to secure water storage to the plants.

It may, at first, be thought that this very storage might give rise to rot of the roots, but the pits are so large and apart from one another, drainages so well combined and the loosening of the soil by hoeing, is so frequently performed, that this needs to be feared.

"In high elevations there is doubtless, atmospheric moisture to nourish the plants during the *greater part of the year,* in *consequence of mists* hovering about the crests of hills. But even there a conservancy of water must be of great value—particularly with good drainages to carry off any surplus of water.

Mr. Montclar's plan, besides attending to these two main points contains practical and very useful instruction on many details of coffee cultivation—each of undoubted value.

I do not hesitate to say, that this improved plan of coffee cultivation is decidedly more expensive than the one commonly adopted. It cannot be otherwise. Mr. Montclar himself estimates it at Rs. 400 per acre or six lakhs of Rupees for 1500 acres, till the first crop is gathered. According to the lay of the land, the nature of the soil the price of land, the labour market (&c.) this estimate will have, of course, to be modified, but I strongly think that it is not an over estimate. It is, as I said, expensive; but coffee planters, as all men, must remember that if a thing is worth doing at all it is worth doing well, and that Rs. 10 spent well, is better than Rs. 100 lost by carelessness and want of foresight.

"I fully trust that Mr. Montclar will carry out his project of opening out his 'New-Hope' joint stock estate and that full success may reward his laudable enterprize.

"RAMA VARMA,
"*First Prince of Travancore.*

Trevandram, 4th April 1878."

No paper or papers, no writing or writings, no injury or injuries can ameliorate the *existing* plantations (coffee, cinchona, cocas, (&c.) on steep lands, but *practical application* only, fully made, and therefore some Rs. 18 are required per acre, so as to be in a position to obtain and secure all the points mentioned in (a) (b) (c) and (d)—and to be then in a splendid and complete agricultural condition, on the steep lands, and be in a condition to expect financial success, instead of deception. I have made that publication short but to the point, avoiding many details of importance for scientific men, but of no importance for practical men.

Climate, moisture, elevation, nature, are entirely in our favour, but our present agricultural condition is entirely in opposition to climate, moisture, elevation and nature! Well let every one help himself fully, and I am certain that God will help all of us powerfully, if we do not remain in opposition to the rules of modern agriculture and in opposition to the Laws of Nature.

A. MONTCLAR,
Civil Engineer.

Member and Professor of the Philotechnique Institute I. N.
(Section of Industry and Manufactures.)
Travancore—Trevandrum, 3rd June, 1878.

TOBACCO.

We see it notified in the *British Burmah Gazette*, that the tobacco crops in the Arracan Hill Tracts are remarkably good the year The leaf has been much improved of late years, we are told by the introduction of Manilla and Havanna seed, which grows luxuriantly. Captain W. G. Hughes, Superintendent of Arracan Hill Tracts, will be glad to give any information as to means of transport, quantity, and so on.

A CORRESPONDENT of the *Pioneer* writes enthusiastically of the future of tobacco in the Kangra Valley —I am not without hope that some day the Kangra Valley may produce tobacco as well as tea. The early part of the season was particularly unfavourable; but with the cessation of hail in the middle of May, and the fine hot weather in June, such of the plants as were able to pull themselves together, ripened off well, and have been harvested. Some that I have seen curing give good promise. The hot and excessively dry climate of the Punjab is not naturally adapted for curing tobacco, the tendency of which, without special precaution, is to dry off green and become worthless; but in the instance I have alluded to, by means of artificial evaporation a good brown, and in some instances golden, colour has been fixed in the leaf. The pamphlet on tobacco cultivation, issued by the Director of Agriculture, N.-W. P., has been of supreme assistance, and fully deserves the many encomiums lavished on it. I believe the flavour of hill tobaccos will be superior to any thing that can be grown on the plains, and some which I smoked the other day, and which, manufactured in the Valley last year had had time to mature, though mild, was far pleasanter than any imported tobacco I can purchase. If in a season of hail and cold like this good tobacco can be grown, I do not see why it should not succeed excellently well in an ordinary year, and I believe it only wants a little patience, perseverance and experience to develop the industry.

ABOUT a year ago a company was started in Madras for the purpose of growing tobacco at Dindigul and manufacturing cigars, for which there is always a demand in Madras and other parts of the presidency. Certain of the leading merchants in Madras and also some of the members of the bar interested themselves in the undertaking, bought a tobacco plantation from Captain Campbell, then at Dindigul, and began to grow tobacco, manufacture cigars and sell them. For a few months the scheme prospered, but with unseasonable rains and the consequent damage caused to a large and valuable supply of cigars, the wants of customers could not be met and the company could not meet its engagements. The capital was one lakh of rupees with about seventy thousand rupees fully paid up. If the enterprise were economically managed the company might have got on. But with an expensive establishment and no efficient man at the scene of operations what might have turned out a remunerative undertaking proved to be a failure; all the monies paid in by the shareholders were absorbed, and if report speaks correctly, funds are needed to carry out the expences of liquidation. It appears also that the Registrar of Joint Stock Companies has come down upon the Directors, for not filing the accounts under the Provision of the Indian Companies' Act of 1[illegible]. Such in short has been the career of a company from which the best results were anticipated. The demand for tobacco and cigars in the past six months and more has been very great; and the "Best Trichinopoly cigars," sold in the retail shops turn out to be of the very worst description.—*Madras Standard.*

OLD smokers of the Burmah cheroot cannot but have observed how greatly the quality of the now far-famed "Burmah" has deteriorated in the course of the past ten years or so. The reasons of the falling off are said to be first, the great comparatively inferiority of the tobacco at present imported from the Madras Coast, and secondly, the lady-makers here, finding the demand for the article rapidly and extensively on the increase (thousands now find their way even to England) content themselves with a more rapid but greatly less satisfactory style of manipulation, both in the previous preparation of the leaf and the final rolling.

FROM the replies received to a circular addressed by the Imperial Chancellor to the various States constituting the German Empire, requesting to be furnished with their views on the question of establishing a Government monopoly in tobacos, it appears that Saxony, Wurtemburg, Hesse, and the great majority of the smaller States have declared in favour of the proposed measure, while Bavaria, Baden, Mecklenburg, Oldenburg and the Hanse towns stoutly oppose the monopoly.

SERICULTURE.

EXHIBITION OF SILK COCOONS.

Memorandum on the Exhibition of Cocoons at Gurdaspur by F. HALSEY Esq. Sujanpur,—dated 10th May 1878.

THE quality of the cocoons exhibited at Gurdaspur on the 24th ultimo, was very superior to any previously exhibited. I have no papers by me from which I can judge as to the number of exhibitors as compared with former years; but it appeared to me that the numbers were in excess of any former occasion. But of this I am sure, there were many new exhibitors, many who have always exhibited were not present, simply because the whole of their silkworms had died. I will refer to the point further on.

The arrangements at the exhibition were admirable; the cocoons exhibited by zemindars were judged by two professional experts in silkworm rearing, and those exhibited by the latter were judged by zemindars, who understand the nature of a good cocoon, assisted by myself. When 50 to 100 heaps of cocoons are scattered promiscuously about a house, and the exhibitors be prevented from seeing where their cocoons are placed, and with ordinary care being taken, collusion is impossible.

It was found that all prizes offered could not be given, and there was a wide gap between the cocoons of those who received prizes and those who did not.

The first two prizes among the professional silkworm rearers were taken by Subhan Mulk of Namakot, and Piraditta of Narot Jaimal Singh. The former always rears his cocoons in the high sandy lands along the road leading from Gurdaspur to Kalanaur, and Piraditta, in the neighbourhood of Narrot Jaimal Singh, two districts subject to the very opposite conditions,—the first being a high sandy tract where there are few trees but alongside the road, the second in the centre of the *Andar*, the best watered and most heavily timbered tract in the Punjab. But it must be remarked that both are thoroughly well drained, and I have little doubt it is very much to this that their universal success may be attributed. Their cocoons were far better than any others in the exhibition, also from another cause—namely, they were the produce of eggs imported from Italy. I do not remember the name of the man who took the first prize among the zemindars; but he also resides on the high lands between the Bari Doab Canal and the Beas.

I do not think there has been so much mortality among the silkworms this year as last, but still there has been much, and so it will remain until the rearers change their system. I believe, in the first paper I wrote on this subject, I explained how important it was that the cocoon should be ready by the first week of April, after which we always are liable to suffer from a few days of bad weather, absolutely fatal to silk-worms; and the main object of the prizes in Gurdaspur was to encourage the early maturity of the cocoon. This has unfortunately been entirely lost sight of. Some few who thoroughly understand this, whose cocoons were ready by the 1st of April, were unable to attend the exhibition, as the cocoons exhibited must be alive,—either the moths had come out, or the chrysalises had been destroyed to save the value of the cocoons. Consequently those who had seized the purport of the wishes of Government were those who were unable to compete even for the prizes. As promised last year, I distributed during the past winter many hundreds of thousands of Chinese mulberry cuttings to all who came for them. A few demands were made from this district, but by far the larger number came from the neighbouring districts of Hoshiarpur and Kangra. I again repeat my offer, and to any who like to apply, I will distribute as many Chinese mulberry cuttings as they may want gratis, but I would ask that lists might be forwarded to me by 1st December next of probable requirements, in order that I may make the necessary arrangements. I do not wish to throw this labour on the district authorities. A list sent to me by the zaildars of neighbourhoods in which the mulberry thrives will be quite sufficient, and on receipt of their lists I will inform them when the cuttings will be available.

As I am satisfied that it is only by having a large supply of the Chinese mulberry all over the district, that we can ever hope to see the produce of silkworm culture one of the staples of the district, I think, for a time, it would be well to offer prizes for plantations in lieu of for cocoons. Whenever large plantations are formed the cocoons will come of themselves, and then little encouragement will be necessary, as the profits in raising a successful crop of cocoons have now become notorious all over the district. I do not think that prizes should be offered for the extent of land under Chinese mulberry, but the manner in which the plantations are kept; and as an aid to this purpose, I am publishing a small pamphlet on this subject and on the rearing of the silkworm in Urdu, which it is my intention to distribute amongst those who like to take it. There may be seen a difficulty in assessing these prizes, but I think there need be none, if *lambardars*, of villages be instructed to send in a list of plantations to their respective *zaildars*, who could again report to their respective *tahsildars*, who could during their cold weather peregrinations report on those plantations most worthy of inspection. I should be then most happy to go round and assist with my advice and opinion as to those most worthy of reward.

Doubtless a great many people only rear a few silkworms for the sake of the reward they hope to get, but although these people are not directly likely to make the rearing of the silkworm a staple trade, the large prizes received by them make others take to it, and amongst these latter are no doubt some who take to it as a trade: consequently it is a question which I will leave to others to decide whether the prizes for cocoons should be continued or not, being given instead for the best plantations of Chinese mulberries, or whether some prizes should be given to cocoons and some to plantations.

In conclusion, I have the honor to offer one prize of Rs. 500 and two of Rs. 250 each for the three best plantations of Chinese and Philippine island mulberry trees in the Pathankote *tahsil*, each plantation not to be less than two *ghumaos* in area, the prizes to be adjudged by an officer appointed by Government, whom I shall be happy to assist, in December 1879. The cuttings put down in January 1879 will then, if properly cared for, be 4 or 5 feet high.

And I would ask in return that my offer might be made widely known to the zemindars of the Pathankot pergunnah through Government channels of communication.

No 181C., dated 26th June 1878.

From.—J. G. CORDERY, Esquire, Officiating Secretary to Government, Punjab.

To—The Secretary to Financial Commissioner, Punjab.

In reply to your No 662, of the 14th June, forwarding reports upon the exhibition of silk cocoons held in Gurdaspur during April 1878, I have the honor to convey the acknowledgments of the Hon'ble the Lieutenant-Governor, to Mr. Halsey for the assistance which he has rendered in the development of this most important branch of industry and for his liberality in the bestowal of prizes in order to its advancement.

2. His Honor considers, in accordance with the suggestions made, that the exhibition should be held in future in the first week in April. At the same time he sees it is necessary, in order to ensure this, that plantations of the Chinese mulberry should be encouraged throughout the neighbouring *tahsils* to as great an extent as possible. The offer which Mr. Halsey makes of distributing cuttings of this variety of plant gratuitously should be made as widely known as possible through the *tahsils* of Kangra, Nurpur and the district of Gurdaspur.

3. The offer of Rs. 1,000 to be given as a prize for the best plantation of the Chinese mulberry is also accepted with the thanks of Government. It may be a question for Mr. Halsey to determine hereafter whether prizes for plantations which reach to a certain standard will not be a preferable mode of distribution to giving competitive prizes. It is understood by His Honor that these prizes will be given in December 1879, as this will allow time for plantations to attain a certain growth, nor need they interfere in any way with the distribution of prizes for cocoons as hitherto.

CINCHONA.

A CORRESPONDENT in the Wynaad writes:—"I saw the other day a very fine specimen of a young cinchona leaf which measured 16 inches in length and was 13½ broad, of the *succirubra* variety, which seems to grow well and easily here, and up to the present, is the one which has been principally cultivated on the estates. But other sorts are being tried; the plants, however, are very delicate. I know of a good nursery of *officinalis*, which promises very well, and I have here five boxes, in which seeds of the *calisaya* variety have been sown, but I am sorry to say without any very brilliant results, comparatively few of them having come up at all. They seem most capricious and fastidious plants to deal with in the days of their youth; either the place they are set in is too dark, or not enough shaded, or just the very least too much or too little water has been given, and any one of these apparently small mistakes are enough to destroy the young plants or prevent the seed from coming up at all."

PENDING the report of the Committee which is to investigate and give its opinion as to the possibility of locally manufacturing the Nilgiri cinchona bark into a cheap febrifuge, the Government of India has, we hear, deputed Dr. King, the Superintendent of the Botanical Gardens at Calcutta, who is in charge of the cinchona operations at Rungbee, to visit Madras and the Nilgiris, and to lay before the Madras Government any explanation they may want with reference to the local manufacture of cinchona alkaloids.

OUR cinchona planters should be on the alert against the importation of an insect capable of committing serious ravages on the bark and which has already appeared in Java. The insect (a hemipterous one) when winged or in the unwinged state feeds upon the juices contained in the younger portions of the bark. The parts attacked cease to grow; the leaves as well as the young branches droop, wither, and become black. Many precautions have been taken by the Dutch cultivators against the multiplication of the pest, one being the prohibition of the destruction of birds in the neighbourhood of the trees. The low-lying plantations have suffered most, those situated above a height of 3,000 feet being comparatively safe. It has been observed that the insect also attacks the tea plant.

A VERY general complaint comes from the London Brokers that the last season's cinchona bark is of inferior quality, and compares unfavourably with similar descriptions sent home in previous years. In the Crown Barks all the three kinds—*natural mossed*, and *renewed*, showed on analysis, a deficiency in the quantity of alkaloids, especially in quinine which averaged 10 per cent. The Succirubras were very inferior, the deficiency averaging 25 per cent Whether this inferiority of the last crop is attributed to purely local causes, or whether it is the result of age, is a question which we think should engage the serious attention of the Cinchona Committee, now sitting to decide the future of the Government plantations. The deliberations of the scientists engaged in this work, will no doubt largely affect the cultivation of cinchona by private enterprise, and the Government could not perform a more beneficial public duty, at this moment, than to make public, as soon as possible, the conclusions arrived at upon this momentous question to capitalists who, with breathless anxiety, await the decision. If the inferiority reported is the result of drought, and we are inclined to think that it is a highly probable cause, the hopes of planters will rise with the return of more favourable seasons; if, on the other hand it is the result of age, surmised by the late Mr. Broughton, the Government Quinologist, then cinchona planters must hasten to make the most out of their properties before the trees pass the age of profitable cultivation The high prices of cinchona bark in 1877, have in a measure, reacted prejudicially upon the sales of 1878 the purchasers of bark are now more cautious in what they buy. It won't pay manufacturers to buy any but the richest bark to enable them to make the most out of the exceptional prices of quinine now ruling.

The Government has directed that samples of cinchona bark shall be obtained from each of the plantations, and sent home for analysis. The analyses are calculated to shew the changes produced by age, and the quality of bark produced from various species and varieties grown at different altitudes, and under different modes of treatment, coppicing and mossing primarily. It may not here be out of place to remark, that however anxious the Government may be to give the public the benefit of whatever knowledge is accessible regarding the cinchona experiment, its laudable intentions are defeated by giving such information in a fragmentary and spasmodic way. Growers of cinchona are absolutely ignorant, owing to the conservatism of the local Government of all the earlier processes of cinchona cultivation, the errors committed and the remedies adopted, when such errors were discovered. Captain Campbell Walker's report may go a long way towards supplying the deficiency, but it can hardly deal with the details of processes and must from its brevity, omit a vast amount of information on an almost inexhaustible field of research. If the Government could place before the public official papers from the commencement of the plantations, it would confer an inestimable boon upon the district. Official information on the subject, certainly appears in the Parliamentary Blue Books, but the earlier numbers of these publications are very scarce, and the latter ones are not accessible to every body.

ADVERTISEMENTS.

NOTICE.

MR. F. A. COHEN is appointed Manager of the *Statesman and Friend of India* Office, and has assumed charge this day.

All communications concerning the general business of the Office, Advertisements, and Subscriptions to the daily *Statesman and Friend of India*, weekly *Friend of India and Statesman*, and *Indian Agriculturist*, should be addressed to Mr. Cohen.

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R. KNIGHT,
Managing Proprietor.

Calcutta, 18th April 1878.

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NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb. 1876.

R. KNIGHT.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

MESSRS. COLLINS AND CO.'S PLOUGHS.

TO THE EDITOR.

SIR,—I have just noticed the paragraph in the *Agriculturist* of July 1st, referring to the offer made by Messrs. Collins and Co. regarding a light steel plough. For several years I have been trying to procure a light plough and have experimented with many modifications of English ploughs without success.

If Messrs. Collins will send me one of their ploughs, either free of charge or otherwise, I shall be glad to give it a careful trial. I should especially like to have such a plough before November, as I am going to have an Agricultural Exhibition in Budaun at which I shall have several specimens of ploughs publicly tried.

Perhaps it will be impossible to procure such a plough before that date, but in any case I shall be extremely glad to have one. If Messrs. Collins do not feel inclined to send one gratis, I shall willingly pay for it.

T. R. WYER, C. S.,
Budaun, N.-W. P., (on leave.)

Naini Tal, N.-W. P., July 26.

NOTE.—We have forwarded a copy of Mr. Wyer's letter to Messrs. Collins and Co.—ED., *I. A.*

THE SAME.

SIR,—In your issue dated July 1st, is a quotation from a letter written by an American agricultural implement firm to you, asking for a trial of ploughs they make. What the exact pattern they refer to may be, I do not know, but I have had some experience in using ploughs of American pattern, which are especially recommended, as Messrs. Collins' are for their lightness.

Light-weight ploughs are generally supposed to be ploughs of light draught, but I can say that with American ploughs, as in reality in almost all cases, this is a great mistake; the dead weight of a plough, although a factor is not a very important factor in causing an increase or decrease of draught. Messrs. Collins, I observe, studiously avoid naming the nature of animal which will draw their ploughs singly, a dray horse might be meant. or even an Indian bullock weighing 300 lbs. live weight only! They are also wrong in saying that Howard's dwarf pony plough weighs 140 lbs., in reality that description of plough and Ransome and Sim's similar implement, both weigh under 90 lbs. You will find in the annual reports of the Madras Agricultural Department for 1871, 1873, and 1875, references to detailed trials of various ploughs; in the latter you will see why the American ploughs fail; they are suited no doubt for some operations, but being constructed on false mechanical principles, they are very inefficient; they are well suited for the shallow horticulture of the States as they turn over a great deal of ground and leave it fit for sowing without the necessity for a harrowing.

CHARLES BENSON, R. R. A.C.

Madras, 29th July 1878.

LOCAL IRRIGATION.

SIR,—There can be little difference of opinion that the effects of famine in India would be much mitigated, if our agricultural population were to show a greater spirit of self-help, and more especially as regards works to provide against bad seasons. There are many works of irrigation of a small local nature, for instance, that might be carried out by an association of landholders and cultivators, somewhat similar to those existing in France and Spain. In those countries the system pursued is well described in a recent report on irrigation in nearly the following words.—The land proprietors of any particular district agree that they would like to construct a canal for their own use, and promise to pay in proportion to the area of the land they wish to irrigate. An application is then made to the Government for the use of a certain quantity of water. The engineers of the Ponts-et-Chaussées (the French D.P.W.) examine and report on the project, and the works are carried out under an engineer appointed by the Association. In every case the designs must be approved of by the Government officers, and the works when finished remain entirely in the hands of the Association, who retain an engineer or an overseer to look after them. Each *commune* watered sends a deputy to a general committee of Management, who order the whole of its affairs, under sanction of Government and the Préfet of the Department, who has more or less control over the concern.

A scheme of this kind in India would require many obvious modifications; for instance, the landholders and cultivators alone would be unable to subscribe the whole of the capital, and small capitalists would have also to be admitted into the Association, which would take more the *form* of a commercial *company*, and their *money* would have to be realised by a water-rent, the limit of which would be fixed by Government. The Government would also have to assist the company in the acquisition of land, and in other ways. But with encouragement and assistance on the part of the district authorities, and countenance from the Local Governments, much might be done. I will give a general idea of a project of the kind that might be established on any river having a small perennial flow—such as the Goomtee in Oudh or the Raptee in the N.-W.P., and several others. A favorable site for the head of the proposed irrigation cut would be selected, and a dam constructed across the river to raise the level of the water during the period from the end of one rainy season to the commencement of the next. This dam would have to be of such a construction that the waterway of the river in high floods should not be interfered with, but it should admit of being closed when the river is in its normal condition in the rains, so that water should be available for the transplanted rice crop—one of the most important in this part of the country. From the dam the canal would be taken along the highest ground the levels would admit of, until it reached the water-shed line between the river and the next principal drainage (these generally run in gradually converging lines from West to East), whence it would continue to follow the ridge between the two streams until their confluence was reached. The canal would irrigate the land by natural flow, in most cases, for its whole length, which would be determined by the quantity of water available, and the features of the country. Perhaps about 10 to 20 miles would be the average length of such a channel, and irrigation could be carried on from it to a distance of 1½ miles on either side (after the line gained the ridge, but before that on one side only). Each such canal then would provide irrigation (taking ⅔ of the area commanded as watered in the whole year) from 20 to 40 square miles (16,800 to 33,600 acres), which at the ordinary water rates would not represent a less revenue than Rs. 21,000 to 42,000 a year. What the cost of such a scheme would be is of course a question that could not be answered without a detailed survey and other information, but if properly carried out, and carefully worked afterwards, it ought always to pay at least 12 to 15 per cent.

There are very few districts where one (in some cases more) such project could not be formed, and the canal would be under the control of the cultivators (subject to the Collector) from one end to the other. And I cannot help thinking that until all these sources of irrigation are fully utilized, it is premature to fall back on well irrigation, as has lately been discussed. Small projects such as has been described could be equally carried out from "Tuccavee" advances when once the landholders were got to agree to that method.

ENGINEER.

N.-W.P., August 16th, 1878.

BAMBOO AS PAPER STOCK.

SIR,—Your editorial foot-note to my remarks in your June number states "the main point on which virtually the whole question centres." Like Mrs. Glasse indeed in her celebrated Cookery Book, who, when describing how to make hare-soup, commences by saying "first catch your hare," you pertinently put the question, Can young "bamboo shoots be produced on *plantations* and laid down at a "central factory leaving a margin to the cultivator (*i.e.* producer)"?

In reply it appears to me only reasonable to assume that as bamboos exist indigenously in such great abundance in the native forest, no great amount of either skill or intelligence should be required to lay down a plantation assimilating in favorable conditions to such native forest; and how this has to be successfully done has been, I think, clearly shown in the two letters from Mr. Robert Thomson, the Government Botanist in Jamaica, published in your journal in March and May.

That Mr. Thomson is no mean authority, we know, seeing the successful result of the cinchona plantations he has established in Jamaica, and I prefer resting on his authority to quoting the reports of several other correspondents to the same effect.

The bamboo, however, must be propagated from stem cuttings and not from rhizomes or root offsets, nor waiting for the formation of productive stools from seeds (nature's system of propagation, which would be too tedious).

Mr. Thomson and others conversant with the "habit" of the bamboo, have assured me that once the plantation established, say in two or three years at the outside, assuming that the stem cuttings are planted at a favourable season, and under other suitable conditions, that young herbaceous shoots fit for cutting will be available, and that the quantity I have assumed for cropping annually, *viz.*, 40 tons per acre, may fairly be assumed as reliable. I may also remark that the plantation once established, no further cultivation will be needed, the young stems being cut or thinned out judiciously, leaving a certain number, say one-third, to maintain the continuous growth and vegetative functions of the parent stool.

The cost of carriage of the stems to a factory necessarily forming a considerable item of cost, due consideration must be given to locating the factory in near proximity to the plantation, and obviously both of them as near as possible to the port of shipment.

These essentials assured, it appears to me, that young bamboo shoots can be laid down at a factory at a cost which will not only leave a margin to the cultivator, but assure a large profit to the manufacturer of the "Paper Stock" producible therefrom.

THOMAS ROUTLEDGE.

Clowbough, Sunderland, 5th July, 1878.

NOTE.—Will some of our readers in the Forest Department exchange notes on this subject with Mr. Routledge?—ED., *I. A.*

REANA LUXURIANS.

SIR,—I observe in a late number of the *Indian Agriculturist* that the Agri-Horticultural Society of India have the translation of a French paper on the *Reana Luxurians.*

There are a great many people in India who read or who take in the *Agriculturist*, but whose agricultural operations are not on a scale of sufficient importance to make it desirable that they should become members of that society, and there are others probably who already belong to some local society.

The introduction of a more numerous variety of good fodder plants is a matter of interest to every European or native who keeps a horse, we believe, the publication of the translation of the paper would be an act worthy of such a paper as the *Agriculturist*, and as far as India is concerned, it appears to me that if all the agricultural societies and gardens were to drop their individuality so far as to pour in their several experiences to one great reservoir, such as the *Agriculturist* is for diffusion amongst the leading public, it would be for India a national benefit, and materially strengthen the only paper which devotes itself to the agricultural and horticultural interests of India to the exclusion of foreign subjects.

India cannot support more than one paper of the class, and I am of opinion that with such a fair start as the *Agriculturist* has made, the several societies and public gardens could not possibly benefit the general diffusive agricultural and horticultural knowledge than by making it the repository of their annals and experience.

WELL WISHER.

Bahawulpore, 19th July 1878.

NOTE.—We shall endeavour to make room for the paper in our next.—ED., *I. A.*

THE LONG STEMMED RICE.

SIR,—It is pretty generally known that the long stemmed varieties of the rice plant will grow in marsh lands where the water is very deep; sometimes when it is 20 feet deep. But I suppose the ground has to be completely drained off some time or other in the course of the year, so as to permit of tillage and sowing or transplanting. I have been told, however, by several persons that in some places in the Eastern districts, and even on the west of the Hooghly river, the plants may be grown without the waters being drained off, so as to leave the ground dry. Two processes are said to be employed for this purpose.

1. Sometimes the plants are taken up from the nursery, and a small lump of clay is attached to the root of each plant or a bundle of them. They are then carried on boats and dropped into the water. It is necessary before this sort of transplantation takes place, that the plants should be longer than the depth of the water into which they are dropped, so that when the roots, weighted as above described, touch the ground, the tops of the plants remain above water and are exposed to the action of sun and air.

2. The second process is to attach the plants when taken off the nursery to long sticks and then to stick them into the ground, the water being too deep for the plants to be set up by the hand.

I am anxious to learn if the above information is correct; and if so how the fact is to be accounted for scientifically.

Calcutta, 28th July 1878. INQUIRER

NOTE.—Can any of our readers tell us anything about this?—ED., *I. A.*

USE OF CACTI AS LIGHTNING CONDUCTORS.

SIR,—There appeared in the news columns of the *Englishman* of recent date, the report of dwelling houses being protected from lightning by placing on the roof a broom-stick with a bundle of straw attached to its end. How much truth there may have been in the report is a question I don't mean to raise, but I wish to place before your scientific readers, for explanation, a similar practice long in vogue among the natives of this city. I mean the practice of using a species of *Cactus* (called in Bengallee *Canj Caurun* or preventer of lightning) as a lightning conductor. Almost all native dwelling-houses of this city with no metallic conductors, have an earthen pot of that particular species of *Cactus* placed at the roof to serve as a protection from lightning. Every one uses this plant, but no one can account for it and I should like to be enlightened on the subject.

Calcutta, 22nd July 1878. X.

IMPROVED BREEDS OF CATTLE.

To the Editor of the Pioneer.

SIR,—In your editorial remarks of the 24th ultimo,* respecting the endeavours of the Department of Agriculture to improve the cattle and sheep of India, you do not say much about the most important point,—*viz.*, whether the improved breeds, or their progeny, could be fed for many years in succession. It is quite certain that they could not, so long as India remains what it is. The native cattle and sheep are the results of the "survival of the fittest by a process of natural selection." During the frequent famines which have occurred, sometimes locally, sometimes generally, for ages past, only those animals have survived which, owing to size, shape, and peculiarities of [illegible] were able to support life upon the smallest quantity of nutriment. Looking at the working bullock generally used throughout India it will be seen that he is, firstly, small both in bone and size of body; secondly, compactly shaped, with round chest and deep barrel; thirdly, short in the legs. Every experienced cattle-breeder in England knows that such peculiarities enable an animal to fatten upon the least quantity of food and in the shortest time, and it does not need much acquaintance with mechanics to see that short legs give him the power of working *at his own pace*, with the least expenditure of muscular force. The sheep of India are usually shaped like the bullocks in their bodies, and their long legs are no detriment, because they do not have to work. All the attempts then to improve the native breeds of cattle and sheep are likely to be a sheer waste of time and money, until by irrigation or an increased rainfall, a regular supply of sufficient food is ensured. A few native gentlemen gladly accept the bulls and rams offered by Government, because they can afford to buy enough food for the progeny in years of scarcity; but to the average ryot those animals are useless. He, too, would probably soon adopt the improved breeds if only he could feed them; for in all the British Empire there is not a better judge of horned cattle than the Hindoo agriculturist. It is doubtful if we can even teach him anything in the art of farming. Considering his means, or rather want of means, the crops he raises are wonderful, and it would puzzle a Scotch farmer to produce as good with the same miserable appliances. He cannot manure his fields because, owing to want of forests, every particle of dung is required for fuel. He cannot plough more deeply than at present, because his little bullocks are unable to draw improved ploughs. Let us leave off troubling the poor fellow with our so-called improvements until we have increased the rainfall by planting trees, or otherwise supplied his land with water by canals, want of which is surely the cause of nine out of ten famines, as is proved by the fact that they are scarcely ever known in the districts already irrigated.

J. J. M.

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* Quoted on page 305 of this issue.—ED., *I. A.*

FLORICULTURE.

SIR,—Can any of your readers, through the columns of your paper give me some hints as to the training and pruning of roses in a climate like that of the Peshawar Valley.

The roses I refer to are John Hopper, La France, Black Prince, Maréchal Niel, Souvenir de Malmaison, General Jacqueminot, Field of Cloth of Gold, &c. I have myself noticed that the season for imported roses in the valley commences about March, and lasts till May, when they go out and few buds appear again till the next spring, there being no regular autumn season like they have down country. I have thus merely pruned down my rose trees once in the year during February. I should be obliged by being informed whether I am wrong in my mode of treatment, and if so at what periods the pruning should be carried on, and what manure used. Any advice will be most gratefully received by

BAGHBAN.

SUGAR-CANE CLEANING IN MAURITIUS.

(To the Editor of the Pioneer.)

SIR,—A correspondent has requested information as to the periods and system of cleaning canes at Mauritius.

In Mauritius there are two kinds of soil—the stony and the free soils. The Indian soils are somewhat like the latter, and I shall only therefore treat of the system therein followed.

In the first place *all* sugar-canes are planted in square holes about 15×10×10 inches in rows 5 feet apart with an interval of 12 to 18 inches from hole to hole along the lines. These are dug out with the hoe, the land well cleaned, but *not broken up nor ploughed.* This is necessary on account of the rapid slope of the fields, else the surface soil would be washed away at every heavy shower. As the young canes grow up, the whole surface is carefully cleaned, *and kept clean* by the hoe, until the canes close in over the interspaces, which will be generally in about four months, when weeds find difficulty in living without light. If the estate be well kept and well manured, the cleanings will be made at intervals of 4, 5 or 6 weeks, and even more. If the estate be neglected and [illegible] it will be necessary to clean every 3 weeks, until the weed be [illegible].

The [illegible] in free soils is known as Elwell's No. [illegible] 10 inches long, and 7 broad, worked with a handle of about feet 3 to [illegible], and the cutting edge should be kept sharp. I think the weight (speaking from memory) is about 6lbs.

I enclose a card, and shall be happy to give your correspondent or any [illegible] information of any description respecting cane planting or sugar [illegible] Mauritius and in fact am very desirous of observing it here.

J. CALDWELL,
Emigration Agent, Natal.

THE NEW TREE FOR INDIA.

SIR,—In your last issue you give an account of the Pithecolobrum Saman, in which, however, one most important characteristic of the tree is not touched upon. It is this, that under certain circumstances the pods are poisonous to horses and mules, but not to cattle or sheep.

The pods on falling to the ground are agreeable, eaten by cattle horse, sheep, &c., but *if rain falls on the pods which lie on the ground*, the horses eating them are at once attacked with a violent colic (locally belly-ache) which is extremely difficult to cure. In Jamaica the pods are largely used as described by you, and are packed in barrels to be kept for the dry season when grass is scarce.

I have about a dozen plants growing here from seed supplied through His Highness the First Prince, and as far as I can tell now they appear to find the climate and soil agree with them.

STEPHEN HONLEY.

Travancore.

PRESERVATION OF FORESTS.

SIR,—It is now universally allowed that forests are to be preserved for two reasons—firstly, for timber, and secondly, because of their influence on the rainfall. It is well known that forests not only increase the rainfall in their neighbourhood, but also store it, so that instead of running off in sudden floods from bare hill sides, it percolates and feeds springs which keep up perennial streams. Government are preserving the forests along the Himalayas, but they seem to have quite overlooked the great importance of the woods and forests which clothe the hills on the *southern* side of the Ganges valley. These hills occupy a great extent of country in the Mirzapore district and in Rewah. They are rapidly being denuded by reckless cutting to supply fuel. They form the catchment basins of the Sone and Tonse, important rivers in which ruinous floods may be expected if these hills are laid bare. The Sone especially is important on account of the canals which it feeds. There can be no doubt that Government ought to protect these jungles. It is even known that civil officers are adverse to the advent of the Forest Department in their districts, but Government should not be blinded by unfavourable reports from civil officials. The forest in Rewah might doubtless be rented in the same way as the forests are in Native Hill States. In all of them, both in Mirzapore and

Rewah, there would probably be a fair return in fuel and timber. The evil effects of denudation of wooded hills (even when only clothed with low jungle and small trees) have been already sufficiently seen in Bombay, where it is contemplated to spend great sums in re-clothing the bare hills; and Government will be acting in a very shortsighted way if they allow ours to be denuded when it is not yet too late to stop the mischief.

BASSILLE.

LOCUST POISONING.

SIR,—I casually came across the following particulars with reference to the manner in which grasshoppers were poisoned in California by the use of the leaves of the Castor-oil tree. The information may be of use to those engaged in destroying the young locusts which are causing so much anxiety in the districts.

Perindurey, 20th July. G. E. B.

"*Castor oil leaves and Grasshoppers.*—A farmer in California has been experimenting with the leaves of the castor bean and reports them as being deadly poisonous to grasshoppers. He had some trees which the hoppers were destroying, and scattered leaves of the castor bean under them. He says—'So remarkable was the result that an actual count of the number killed under one tree showed four hundred and ninety-eight dead ones and about twenty in a dying condition. Only a very small portion of the leaves were eaten; and judging from the effects of the small portion consumed, I believe there was sufficient material left to have killed ten times as many.' He suggests that hedges of the plant be grown around farms and an occasional row in fields and vegetable gardens."

The Indian Agriculturist.

CALCUTTA, SEPTEMBER 2, 1878.

THE WYNAAD AND ITS WANTS.

WHEN the Viceroy visited the Madras Presidency last year, a deputation of the Wynaad Coffee Planters waited on him with a statement of their grievances. These were very numerous, since all their former applications, extending back over the last twenty years, had been met only by promises, which, like pie-crust, were made to be broken. It certainly appears unaccountable that the Government should systematically neglect this great interest, represented as it is by so much capital and so respectable a body of English subjects in this country. To say nothing of the thousands and tens of thousands benefited by the cultivation of coffee in India, it might be supposed that the millions whose health and strength depend on its consumption, as well as those merchants and ship-owners instrumental in its distribution, would obtain some consideration. The great tragedy of the last famine in Southern India led to the extension of coffee-stealing to a ruinous extent; and to this particular subject, together with the absurdity of the extradition laws between Mysore under the Bengal Government and the Wynaad under Madras legislation, His Excellency's attention was forcibly drawn. It was represented to him that the estates being so extensive, in many cases comprising more than a thousand acres it was utterly impossible to protect the crops in the picking season, when every person available was engaged in collecting the fruit, which was frequently carried off the plantations by the people employed in picking, to be handed for a few pies, a seer of rice, or a bit of tobacco, to receivers who laid wait in the jungle to carry it away. Besides this, gangs of thieves infested the forest, who made a profitable business by stripping the trees at night and making off with the booty. If discovered in the act, the punishment was so trivial (a month's imprisonment or twenty lashes), that it did not deter others from following the same occupation. Even if a party of robbers was recognized by servants or watchers employed for protection, but who were unable to contend with numbers, the recognized persons had only to escape into Mysore, where the almost insurmountable difficulties attending their extradition, rendered it useless to follow them. The deputation also represented to His Excellency, that if there were no receivers there would be no stealers. They therefore prayed that such laws might be enacted as should ensure enhanced punishment to the thieves, and impose heavy responsibilities on the receivers. They also prayed that greater facilities might be afforded for the capture of offenders in Mysore. Lord Lytton, with his usual courtesy, promised that the subject should have immediate attention. And at a subsequent interview with His Grace the Duke of Buckingham and Chandos a similar promise was obtained. Our readers may, therefore, be surprised to hear that up to this time nothing has been done. The Madras Government introduced a "Bill for the better prevention of coffee stealing," and the hopes of the Planters rose high; and the Bengal Government ordered some alterations in the extradition laws; but the Bill still lies on the table, and the extradition laws are as they were before. It is an extraordinary fact, and shows how absurdly we manage affairs in India, that although Mysore and the Wynaad are only separated by a small stream that a child could hop over, they are, as regards extradition, further removed from each other than England is from America. That some idea may be formed of the difficulties which the coffee interest in the Madras Presidency has to contend with, we give the following narrative of facts, for the authenticity of which we vouch. During the last season, when bullock-bandies were scarce and difficult to be obtained, a Planter wishing to send his crop to the coast for despatch by a certain ship then waiting, sent a message to a bazaar merchant at Mannantoddi (as had been frequently done on similar occasions), to give notice at the bandy "halt" to any grain carts returning to the coast empty, that they could load at his estate. Two days afterwards a respectable looking man brought three bandies, using the name of the bazaar merchant before referred to. His story was that he was going from Mysore to bring back salt from the coast, and would gladly take down coffee. His offer was accepted, and he went away with 120 bushels of plantation coffee, valued at Rs. 1,200. As he never arrived at his destination, enquiries were instituted, but nothing was heard of either bandies or coffee; no efforts of the police, who, it must be admitted, were unceasingly active, not the most anxious and diligent search of the Planter or his friends, could obtain the slightest trace of the thieves. For two months every effort was in vain, until the proprietor's faithful and attached servant (*the Boy*), entreated his master to allow him to go into Mysore to search for them. He said he had seen his master give the man the advance hire; he had seen the receipts signed and the coffee despatched; the bandy drivers were Canarese, and he was positive he should recognise the whole party, or any one of them again. He was allowed to go, accompanied by the horse-keeper, who had had some conversation with the bandy men, and followed at a short distance by a police constable. With the natural instinct of a trained detective, he disguised himself as a merchant looking for bandies to transport grain to Mannantoddi. For four weeks he wandered from village to village, until in despair he was about to relinquish his search, when he accidentally heard that at a village some short distance off some bandies were expected back which had been for a long time absent. He went to the place and waited a couple of days, when the bandies returned, and were immediately recognized; the bandymen were arrested by the policeman, and taken before the Magistrate. This functionary refused to send them to Wynaad without a Wynaad warrant, but held them to bail in Rs. 1,000 each. The policeman hurried back to Mannantoddi, which was 70 miles distant. The Deputy Collector was on circuit at a place twenty miles away, and by the time the constable arrived there he had removed other twenty miles. He was found at last, and promptly despatched the warrant, with which the policeman had to retrace his steps for ninety miles. On approaching his destination, he met the Mysore Magistrate in his carriage, who took the warrant and said,—"It was all right, but as he was on his way to the Rajah's marriage, he would attend to it on his return, as there was plenty of time." At the expiration of three days he did return, but—the bandymen had decamped. The bail, it appears, was for a *limited period* only, which had expired the day before! Now, in America any person arrested on such a serious charge would, on the production of sufficient evidence, be detained in custody, or if bailed, bailed until such time as the English authorities were communicated with, if the crime of which he was accused was committed in England, and substantiated by evidence produced by a Scotland Yard Officer. But in Mysore, without calculating contingencies, such as the absence on duty of an official, or a Rajah's marriage, a limited time only is allowed for detention, although the evidence be ever so conclusive. The persevering energy of this faithful servant has, however, traced the coffee to its place of delivery; but no proceedings can be taken against the receivers until the bandymen are retaken (and it is very doubtful if they ever will be), since, according to the present law, there is no restriction against one man buying his neighbour's property whether stolen or otherwise, particularly if it is coffee. It is calculated that upwards of one hundred tons were stolen from the coffee districts last season; yet the Madras Government delays its promised legislation on the subject, and the crop this year is expected to be unusually early. This continued loss to the Planters must tell on the largest purse; but unhappily the Government loses nothing, for the duties are levied on the *acreage*, not on the production. So, let the crop be good or bad, let it be brought to market by thieves, vagabonds, or swindlers, or let it not come at all, the revenue on coffee does not diminish. But unless some action is taken, the Government will find out its mistake, for the Planters, unable to bear this continued drain on their enterprize, will be compelled to abandon their estates altogether.

THE "OUDH GAZETTEER."

THIS long expected *Oudh Gazetteer* has at last been presented to the world, or to that small portion thereof which concerns itself with such matters, in three burly volumes. It is prefaced by an introduction in sixty-seventy pages from the pen of Mr. W. C. Benett, C.S., Assistant Commissioner, an officer who has, on one or two occasions, earned notoriety as literary champion of the Oudh Administration, and is also known as the author of an interesting monograph on the Roy Bareilly clans. Mr Benett's essay has all the excellences which a document written to order can be fairly expected to possess. Far less voluminous than the original introduction by Mr. McMinn—which was suppressed after seven copies had been printed—it discreetly steers clear of *questiones vexatæ* and evades the charge of inaccuracy so freely brought against its predecessor, by a judicious avoidance of tabular statements and ambiguous statistics. It may be doubted, indeed, whether it be possible to write an adequate introduction to any account of a province with so eminently controversial a history as that of Oudh, without entering into controversy somewhat more fully than Mr. Benett has seen fit—or has been permitted—to do. But if the task is to be achieved, Mr. Benett may be admitted to have achieved it. "If it's possible to slander an attorney, you've done it," said, or is reported to have said, Baron Martin to a defendant in a libel suit, and the same, *mutatis mutandis*, may fairly be asserted of Mr. Benett's introduction, which is undeniably a brilliant bit of writing—lucid, epigrammatic, and occasionally eloquent. "As the scene of the great national epic, the two greatest of the reforming movements which have agitated the national religion, and the earliest as well as the last of those Mahomedan Governments, in its resistance to which the national spirit was most severely tried and gave the most convincing proofs of its wonderful vitality, Oudh is second to no part of the continent in its command over the sympathies of the native, and the interest and difficulty of the problems which it presents to its European administrator or historian. Nowhere are the traditions of the past more ancient and more vividly felt, and nowhere is the civilization—rooted in a soil of unsurpassed fertility, and grown up in a population of exceptional density—more fully developed and more homogeneous than in this the last case where Western statesmanship has been brought face to face with the requirements of an Eastern people." This is both very true and very well put; but on the whole, we think we prefer Mr. Benett as a narrator and word-painter of early Oudh history, of the physical features of the country, and of the present life and condition of the people, to Mr. Benett as a commentator on the achievements of "Western statesmanship." It is but fair to add that the latter topic occupies a far smaller portion of the Introduction than the former, and that a certain amount of reticence in dealing with it was, under the circumstances, unhappily unavoidable.

The Introduction opens with a sketch of the physical geography of the province, which is followed by a brief account of the flora and fauna. Mr. Benett is probably correct in saying that the wild buffalo is extinct in Oudh; but he adds that it is "many years since the last pair of horns fell to a European sportsman." We know of one being shot in the north-east corner of Kheri not more than six years ago at most. Again, we read that "innumerable herds of diminutive cattle graze along the edge of the northern forest, and are driven into the higher plateaux for the hot months." We know men who have been in camp in the Terai at nearly all seasons of the year, and have seen any amount of "diminutive cattle" grazing in and about the forests, but never heard of their being "driven into the higher plateaux." Gujars, indeed, sometimes let their cattle graze over the low hills in the day time, but always bring them back to their *gaurih* or cattle clearing at night. There are no grassy table lands in this portion of the Sewaliks, which would be suitable for cattle grazing, and in the hot months especially, water would be very difficult to find. On this point, then, we think there must be some mistake. A little further on, Mr. Benett speaks sympathetically of the efforts of the forest officers to preserve their charge from fires, cattle, and the "deliberate thefts of the bordering villagers." This is one side of the case, but there is another,—that of the "bordering villagers," for which there is a good deal to be said, and to which some allusion would not have been out of place. The cause of the people, as against some of the pretensions of the Forest Department, has found an able advocate in Captain Pitcher, whose report on the subject might well have been referred to. As a matter of fact, it may be doubted whether fires are by any means an unmixed injury to the forests, and we have yet to see the effects of, say, 30 years exclusion of fire from a reserved block. If the result is beneficial, the question will be settled. Till then, it should be treated as open. As for depredations by cattle, it is difficult to believe that Forest officers can attach very much importance to them; while they discourage the reduction of the large numbers of wild cattle which are to be found about Bhinga and elsewhere by attempting to impose a "haqq zemindary" of Rs. 5 on every head caught by the villagers, and used at one time even to charge with theft any one who captured wild cattle without a permit, on the ground that they were "forest produce."

The *khair*, or catechu acacia, is stated to "afford a valuable article of commerce and the means of subsistence to a peculiar caste"—the Khairahas, a sub-division of the Chais. This is true only of Nepal. Khairahas are no longer allowed to manufacture catechu in the Oudh forests. Among the wild products used as food by the poorer classes, we see no mention of the *ber* or *bair*—a bush which produces a small berry of a bright orange mahogany colour when ripe, which is gathered in great quantities in November and December, and preserved. The stones, as every *shikari* knows, are very useful in allaying thirst. Mr. Benett remarks that the mango is never found wild, and that its "occasional presence in jungles is a certain proof that the neighbourhood was formerly under the plough." We have more than once come across many trees in the midst of primæval forest, in land which could never have been cultivated. In concluding his sketch of the natural features, climate, and products of the province, Mr. Benett observes that it "is dependent for its wealth solely on its fertile soil, its moderate rainfall, and its generous sun; without any of the precious metals, without coal, or iron, or valuable quarries; it has nothing to stimulate the manufactures which in other countries support a crowded population, but relies solely on its teeming harvests, and the copious natural products which supplement the food-supply derived from cultivation. On these it lives, and these only does it export to procure the money drawn by taxes, the greater part of which is spent beyond its own limits." When we consider that the population over the whole area is 476 to the square mile, and that except Fyzabad and Lucknow, there are hardly any considerable towns, it is not surprising that the people are poor. What manufactures there are, or were—and except cotton-cloth, there is hardly one of any importance—are rapidly being superseded by the products of English machinery and capital. Such a state of things renders the question of starting State manufactures one of pressing practical interest. Mr. McMinn's suppressed Introduction discussed the subject at some length; Mr. Benett makes no allusion to it.

A few facts and figures may be taken at random from the Chapter on the "Condition and Character of the People." The area of Oudh is some 24,000 squares miles, with almost the same number of villages, and some 77,000 hamlets thickly scattered over its surface, giving, on an average, one village and about three hamlets to every square mile. "Every rood" has certainly to "maintain its man" in the Garden of India; whether it "*well maintains*" him, is another question. Out of more than two and-a-half millions of houses, less than twenty thousand are of brick, "and the majority of these have been erected in the days of their prosperity by the Mahomedan settlers." "Ninety-two per cent. of the population is rural as opposed to urban," and seventy per cent. at least are agriculturists, for the good reason that there are "hardly any other productive occupations." Of the village artisans, Mr. Benott points out that their payment is not, like that of cloth-weavers and brass-workers, fixed by ordinary trade competition, but by custom, and generally takes the form of a definite share of the villager produce. "They are really integral parts of that complete political system which has for its basis the grain heap on the threshing-floor at the end of the harvest, and take their place more correctly with the Rajah, the village proprietors, and the tillers of the soil, than with the trading classes." Of three of the chief industries existing before annexation, one—cotton weaving—has been crippled by Manchester competition; another, spirit distilling, has been "formulated by the excise system which converts the independent distiller into a paid Government servant"; and a third, salt manufacture, has been "completely annihilated." Cotton-weavers and salt-makers (*julahas* and *soniahs*) have certainly no cause to bless our rule, which has taken the bread out of their mouths, indirectly as regards the first, directly—and under criminal penalties—as regards the second. The salt manufacture having been crushed, £400,000 worth of salt is imported yearly. The other principal imports are cotton, averaging £340,000 a year, and English piece-goods with an annual average of £400,000. Agricultural produce is exported yearly to the value of more than a million sterling.

THE VALLEY OF THE RIVER SUTLEJ.

ALONG the river's banks (bed 2,500 to 2,800 feet above sea-level) there is a ledge varying in width from 50 feet to a quarter of a mile. The mountain sides then rise steeply, angle varying from 55° to 75°, for about 1,500 feet (of perpendicular height,) when the rate of inclination lessens to 45° to 55° for about 1,000 feet, after which it again becomes steeper—55° to 75° for another 1,500 feet, when the slope becomes flatter varying from 30° to 45; after this the angle increases in magnitude until it gradually becomes perpendicular as it nears the Hattu (Whartu) ridge. On the sides of the immunerable spurs, many tolerably level spots occur which are cultivated.

It may be divided into three zones, the first up to 4,000 feet above sea level, or 1,200 to 1,500 feet above the bed of the river, up to which tropical plants can be cultivated, though the size and yield of produce lessens with every foot of increased elevation. Tea yields well; so does rice. Snow seldom falls, or when it does, it melts quickly; the heat is great. The next zone is from 4 to 8,000 feet in height, and here pines, the cedar, oaks, elms, and other European trees and vegetation grow in great luxuriance and beauty. The climate is temperate, the winter bearable; average depth of snow may be reckoned at about one foot during January and February. Here tea does not thrive beyond 7,000 feet. Wheat, barley, buckwheat, and various kinds of millets yield largely. The third zone consists alternately of immense forests, and large pasture grounds where the villagers graze their sheep in the summer months; cultivation is carried on nearly up to the top, but only in scattered patches, and where suitable land is available.

The fields on the slopes are long, narrow strips of ground, which rise above one another, like terraces, to great elevations, even upon very steep declivities. The supporting wall—stone or sods according to which material happens to be handiest—of each is from two to six, or more, feet in height according to the steepness of the place: they are levelled very tolerably.

The Government revenue for land is divided into four rates, *viz*:—

Rs. 1	0	0	per bigah for *kyar* (rice) land.	
„ 0	3	0	„	„ first class wheat land.
„ 0	1	0	„	„ second „ „
„ 0	0	6	„	„ third „ „

about five hill *bigahs* go an English acre, so that the above cannot be considered a high rate of assessment.

A hill *bigah* is 20 *kadams* long, 20 broad, equal to 400 square *kadams*. A *kadam* is 4 feet 6 inches in length (but in practice becomes nearly 5 feet: a rope is sometimes used but the result is the same, as it stretches in the course of work). Therefore five hill *bigahs* are nearly equal to one acre English. Twenty *biswas* equal to 1 hill-*bigah*, and may be considered as the equivalent of one square *kadam*.

The following Memo. showing proportion of cultivateable land in Hilly Districts, may prove of interest to many of your readers especially so to European settlers, in *esse* or *posse*:—

Name of Plot.	No. of tea plant hole: 3 × 4 apart, = 12 sq ft.	Actual cultivateable land.		Area according to measurements made by local Officials in 1876.		Area according to the *Khasrah* (Field Register Book.) made in 1848.		Slopes and other uncultivateable land.		Proportion of cultivateable to uncultivateable land.	
		Bighas.	Biswas.	Bighas.	Biswas.	Bighas.	Biswas.	Bighas.	Biswas.	Approximately.	
Shart (Uchia-Patia) ...	911	1	5½	...	...	2	11	1	7½	1/2	Khasrah measurement in excess.
Shart (Rania)	3·700	5	...	12	10	3	10	7	10	7/12	
Reura (Nirimdoss) ...	2·030	2	11¾	...	...	4	...	1	8½	1/3	Khasrah measurement in excess.
Bhital (Madden) ...	1·930	2	8¾	9	10	1	5	7	1¼	3/4	
Batal (Nurpat)	3·399	4	6½	22	10	3	5	18	3½	4/5	

Calculation of the proportions:—

$$\tfrac{1}{2},\quad \tfrac{7}{12},\quad \tfrac{1}{3},\quad \tfrac{3}{4},\quad \tfrac{4}{5} =$$

$$\begin{array}{l}
1 \times 12 \times 3 \times 4 \times 5 = 720 \\
7 \times 2 \times 3 \times 4 \times 5 = 840 \\
1 \times 2 \times 12 \times 4 \times 5 = 480 \\
3 \times 2 \times 12 \times 2 \times 5 = 720 \\
4 \times 2 \times 12 \times 3 \times 4 = 1{,}152
\end{array}$$

$$\frac{3{,}912}{2 \times 12 \times 3 \times 4 \times 5 = 1{,}440} = 2\tfrac{43}{60}$$

Divide $2\tfrac{43}{60}$ by 5 (number of examples of proportions) $\frac{163}{60} \times 5 = \frac{163}{300}$ = (nearly) $\frac{3}{5}$; that is to say that only $\frac{2}{5}$ths of the land is cultivateable, while $\frac{3}{5}$ths is uncultivateable: these examples are favourable ones; a larger average would show that only one-third is cultivateable, the remainder of the land consisting of the steep slopes of the terraces, rocky portions, and sides of steep depressions such as watercourses.

There is nothing surprising in the inaccuracy of the *Khasrah*, as the last settlement, in 1848, was a summary one, made by natives; besides, the distribution of the Government demand in a village may have been determined rather with reference to customary payment previously in force than to the area and productiveness of the holding. The holdings are not numbered in the *Khasrah*, nor are any boundaries entered therein, and the villagers have no maps of their fields, while the Government has no boundaries to its property, so that the villagers by gradual encroachments have increased the areas of their properties with great benefit to themselves as they pay no revenue for such extensions.

The villagers sell their wheat land at present at rates varying from Rs. 4 to Rs. 10 per *bigah*, according to situation and quality. Their rice lands fetch fancy prices from Rs. 40 to Rs. 110 per *bigah* (£20 to £55 an acre) dependant on proximity to, and quantity, of water, in a *kúl* (irrigation channel).

There is sufficient land still available in the neighborhood to form three or four tea-plantations.

G. P. P.

ARBORICULTURE IN THE N.-W. PROVINCES.

THE general control and management of roadside arboriculture in the N.-W. Provinces has, it appears from a Circular of the Government, been placed under the Agricultural Department. The step seems to be in the right direction. Hitherto a small grant in each district has been put in the hands of local officers, without any real restriction as to its use, which sometimes has not been employed at all, and sometimes has been devoted to the establishment of small nurseries (scattered broadcast through the district) of which the cost of establishment has been out of all proportion to results. Even where any useful programme has been arranged by a district official who unites common sense with a zeal for tree planting, it has not unfrequently happened (so we understand from the correspondence) that he is succeeded by a series of officers whose tastes lying in some other direction, devote the little leisure they possess, to other, perhaps more important matters. But a tree has a tender childhood and a slow life and cannot afford to be subject to the alternating vicissitudes of attention and neglect. Constant and unremitting care is necessary to bring it to a healthy manhood, to secure which appears to be the main object of the transfer of the general control of road arboriculture to a special department. At present it seems that only the rearing of baby trees is committed to the charge of the agricultural wet-nurse. In the words of the Circular, "the grants for arboriculture being for new or extension of old avenues, while the maintenance of existing avenues forms a part of the repairs to roads," . . . . the latter should remain under the control of the Public Works Department, till the system is developed, "and a further restriction requires that expenditure should be confined to avenues on roads." But the opportunity thus afforded for the extension of arboriculture is certainly insufficient and cannot effect, we fear, any large results, and we shall not be satisfied until we can see in each province practical efforts, such as have been made in the Punjab, exerted to clothe large areas with groves and plantations of useful trees. By large areas we do not mean forests. We have often pointed out that the most useful system of forestry (or perhaps we should descend to the term arboriculture) in the North of India is that which spreads throughout the country a network of groves, plantations and avenues, which will by their shade and obstruction to hot winds temper the fearful aridity which presents such a terrible spectacle to the traveller who is carried from Calcutta to Simla through the heat-stricken plains of the North-West Provinces and the Punjab in the months of April and May. What is it that prevents our Governments from insisting upon the plantation of groves in some form or other? They have insisted upon forests, and forests are growing. Let them insist upon groves and groves will be planted. It is not for us, at any rate until some signs are shown of an inclination to adopt active measures, to suggest the details of a programme which will possibly have to vary very greatly in each Province. But we shall never cease to urge that it is the bounden duty of the Government of India as the educated partner in the proprietorship of the land of this country, to institute an extensive and permanent system of arboriculture (as distinct from forestry) throughout the country, and to oblige in whatever form may seem most practicable each Province to make arrangements for the plantation throughout its extent of groves and groups of trees, in addition to the preservation of forests, which can and do affect but a very small percentage of the whole area, and that percentage too, one which is least important in an agricultural aspect. We are glad to see that this side of the question has been noticed by the Director of Agriculture (N.-W. P.) in his proposals to Government, and that he has urged the agricultural importance of tree-planting in the words quoted below, although we regret to observe that his suggestions are confined to the plantation merely of avenues, which as we have indicated are but a very small portion of the system which should be adopted.

"Arboriculture is the most important element in the agricultural stability of these provinces. To counteract the fearful aridity of the climate in the hot months trees must be spread over the land and not merely concentrated in thick forests at the foot of the Himalayas and elsewhere. Vegetable manure is an alarmingly increasing want which can be partly supplied by the decayed leaves of deciduous trees, and it is also an object to increase by a proper selection the food-supply of the people and of cattle." The last proposition has indeed been insisted on by the N.-W. Government, and after all that has been said and written on the subject it is needless to argue the necessity of following such a course, for it must be utter folly to contend that when trees are planted throughout a country subject to periodical famines, they should be trees which do not bear fruit. And yet what has been the case? We will undertake to say that during the last twenty years more than 90 per cent. of the trees planted under Government authority have been not merely useless as food producers for human beings but in a large proportion of very little value, even as fodder providers for cattle. We recommend the subject as one worthy of the serious attention and authoritative judgment of the Famine Commission.

AGRICULTURE IN INDIA.

[BY DR. FORBES WATSON.]

THE Government of India has the strongest possible inducements for trying every method of improving native agriculture, and among these the establishment of agricultural farms appears to be one of the most important. The yield per acre of almost every description of agricultural produce, is less in India than in other countries in a more advanced state of civilization. The full importance of this inferiority can only be realized when it is kept in mind that the population is there more densely packed than anywhere else, China perhaps excepted; so that, if the cultivated area be divided among the population hardly more than one acre will fall to the share of each inhabitant, whilst even in the United Kingdom, with all its large importations of the agricultural produce of other countries, the share per inhabitant would be very nearly one acre and-a-half. The average crop of wheat in England must be taken at not less than 1,800 lbs. per acre, whilst in India it seldom exceeds 1,200 lbs., and frequently falls to 1,000 and 700lbs. per acre, and in some backward provinces the returns indicate a yield of hardly more than 400 lbs. The difference is even more striking in some of the commercial staples. Cotton yields in India, on the average, only from 60 to 70 lbs. of clean fibre per acre, as against from 250 to 300 lbs. in the United States, and as much or more in Egypt. Such is the case at present, but agriculture is now almost everywhere in a rapidly advancing condition, and the relative inferiority of India is becoming greater, and greater, and threatens to endanger the further development of staples in which she enjoys as yet a pre-eminence. Thus the cultivation of sugarcane and the extraction of sugar has considerably advanced in most of the colonies, but the formerly considerable export of sugar from Bengal has fallen off to a mere fraction of what it has been. There is no staple which may not be threatened in the same manner. America is vigorously trying to develop the growth of indigo and jute. The Burmese rice has to encounter competition from Java, from Siam, and from Cochin China. India's monopoly of opium is attacked from both without and within, by expanding cultivation, and by a blight threatening the Indian crops. Nothing but improved agriculture can preserve and develop the position already acquired by India in regard to these staples. The development of agriculture as bearing on the food resources of the country is important from a two-fold reason. It increases the area which can be devoted to industrial crops, and it increases the certainty of the yearly food crop; it being an established fact that not merely extended irrigation, but also all improvements in cultivation increases the resisting power of crops against the effects of unpropitious seasons, like other causes of scarcity.

It is, therefore, abundantly evident that no Government has ever had more inducements for promoting agriculture than the Government of India. It remains to inquire what are the chances of success to such an enterprise. It is commonly held that agriculture in India is so entirely a matter of tradition, that it is hopeless to attempt the introduction of changes really affecting the bulk of the community. To meet this argument, it is obviously irrelevant to adduce the instances of indigo, coffee and tea, as these have been all developed by and still rely almost exclusively on European enterprise. But independently of the above examples, instances of important agricultural changes can be brought forward which have affected the whole native community. Tobacco supplies a striking example. As appears from the Emperor Jehangir's memoirs, it must have been introduced into India probably by Europeans, early in the seventeenth century; and already in the eighteenth century there was hardly any village without its tobacco plot. Maize, a plant of American origin, is now extensively cultivated in Northern India, and forms the staple food of the population in some of the more hilly parts, such as Nepaul, parts of Chota Nagpore, and Bhaugulpore, as also in the hills of the Punjaub. Potatoes are even of more recent introduction, and are not only largely grown in common with other European vegetables for the use of Europeans all over India, but already form an important crop for native use in some parts, for instance in South Eastern Tirhoot. An instance of the rapid extension of a purely Indian staple is afforded by the developement of the cultivation of jute. Similar instances of change might be multiplied, but enough has been said to dispose of the pretended impossibility of changing the course of native agriculture. It would be difficult to maintain that such a change could not be guided and accelerated by judicious action on the part of the Government.

There is, however, a widespread opinion that even if beneficial action be possible, the obstacles to improvement which have to be encountered in India are of an exceptionally unmanageable nature, and such as to render all hope of important reforms a very remote one. It is very difficult to bring conclusive evidence either for or against this opinion from Indian experience, for the simple reason that whatever has hitherto been done in India in the matter of agricultural improvement has been done so fitfully and unsystematically that it affords no clue to what may result from a better planned action. But the same difficulties as those met in India have obstructed agricultural reform in many other countries, and an extraordinary amount of time and persistent effort has been everywhere necessary to overcome the inertia of the agricultural classes. As a matter of fact, to this day reports may be read from Spain, from Italy, Austria, Russia, and Eastern Europe in general, referring to the state of agriculture in almost the same terms as those used by various official and unofficial gentlemen consulted in Bengal with regard to the establishment of experimental farms. Attachment to tradition, want of enterprise, want of capital, smallness of farms,* and other obstacles to improvement had to be encountered in most countries, and it might also be asserted that almost every instance mentioned in proving the obtuseness of the Indian ryot might be matched by European and even English parallels. If the rate of progress in Europe is at the present time more rapid than any which can be hoped for in India within the present generation, it is because the movement for agricultural improvement, still struggling for its mere existence in India, has in Europe set in a century back, though it has only lasted in full force since the conclusion of the peace in 1815. It is in the nature of progress to go on in an accelerated ratio, each successful venture encouraging others. The great preliminary difficulty is to make the idea of beneficial change, improvement, and progress take root among the agricultural classes. This may be the task of a generation, but, if once effected, agricultural progress will enlist such an amount of spontaneous force on its behalf that its rapid advance in the future is certain. The spread of education in India, even if mostly without any direct bearing on agriculture, will have the beneficial effect of making the minds of people more receptive of change; but time is necessary to bring this influence into action. Time and persistency are the main conditions of success in agricultural reform, and cannot be replaced by any amount of sudden effort. It is time and persistency, which the cause has never yet had in India, that is wanted. Agricultural improvements relegated amongst the minor duties of land revenue officers have never received special and continuous attention. Whenever any start had been made in this respect by some collector or governor, it hardly ever occurred that the matter was taken up by his successor, and thus the attempt only went to increasing the long list of individual failures. If however, agricultural establishments on no larger scale than those now proposed had been organised 25 years, although the effect on the country at large might still have remained very small, there would now be existing all the germs of a rapid development; scientific agriculture would have been already acclimatised in India; and there would not be that dearth of exact information or of suitable agency which now and for years to come, will render all important progress slow and difficult.

A satisfactory feature in the case is the thorough sense which has at length come to be entertained of all the difficulties standing in the way of agricultural improvements and of preliminary conditions for successful action. It is at length recognized that as yet Europeans have next to nothing to teach the natives in matters of agriculture except general ideas; that before Government attempts to direct the agriculturist to better methods, those methods must be discovered; that wholesome importations of English methods, tools and machinery, and of ready-made scientific rules, can meet with nothing but failure; and that a long series of experiments, conducted by specially qualified men is necessary, in order to find out the specific manner in which the general scientific ideas or empirical results of European agriculture can be applied to the vastly different conditions of soil and climate in India, and in order to realise what improvements are suited to the economical position of an Indian ryot. There is no such thing in existence as a science of agriculture which can afford, without further trouble, infallible guidance to the Indian cultivator. It is not abstract science which is wanted, but men with habits of scientific observation of agricultural phenomena. Such men, versed in the principles of the sciences refering to vegetation, and brought into contract with actual agriculture, as carried on under Indian conditions, will in time by patient investigation, discover rules for practical guidance, based on scientific principles, and suited to Indian conditions. The advantage of science is not that it would enable them to dispense with Indian experience, but that it will supply them with better methods of observation, and enable them to profit more quickly by experience, and to derive from it more practical conclusions than could be derived in the same time by men not possessed of previous scientific training.

Thus far the movement for agricultural improvement is barely at its commencement, and nothing could be more dangerous to it than extravagant expectations of its immediate influence on the state of Indian agriculture. The first few years can hardly be expected to produce any other result than to educate and train the officers in charge of the experimental farms. But it can hardly be doubted that, after this preliminary period, really useful results will be obtained, and that through them there will gradually accumulate specific knowledge of the means for further advancement, based upon actual Indian experience, and not upon inapplicable English precedents or vague scientific abstractions. It is at that stage that another condition of agricultural progress will assume great practical importance, *viz.*, the establishment of some organisation for the purpose of disseminating and popularising among the bulk of the people the knowledge that will have been acquired. On the success in this endeavour will depend the economical importance of the information and the degree in which it will influence the country at large.

It may be useful, in conclusion, to give a short view of the organisation existing on the Continent for the furtherance of agriculture.

As regards agricultural education, there exist—

Agricultural acadamies, in which the highest possible teaching is given, embracing the whole range of sciences connected with agriculture.

Practical agricultural schools for farmers' sons, such as the French *fermes écoles*, in which the proprietor of a well-managed estate receives a subvention from the Government, and takes in pupils of the farmer class, who receive in addition to their practical occupation on the estate a certain amount of theoretic instruction also.

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* One difficulty which seems to be considered as peculiar to Bengal, *viz.*, the fact that the holding of a ryot already small in itself, is rendered even more unsuitable for improved agriculture by consisting of several separate plots situated in different parts of the village, had to be encountered in other countries as well. [illegible] and elsewhere in continuation of the Revenue Survey Operation (cadastre) Commissions have been appointed for the purpose of consolidating the farms by mutual exchange of the outlying plots. This process called "commassation" has been carried out on a large scale with very beneficial effects.

Special schools for forestry, horticulture, viniology, pomology; as also veterinary schools.

Agricultural professorships attached to universities and colleges.

Agricultural and horticultural teaching frequently connected with the elementary schools, and provided with suitable gardens and plots of land.

Itinerant lectures on agriculture, maintained or subventionised by Government or by private associations.

The science of agriculture is advanced by numerous 'experimental stations' of a scientific character and in charge of a scientific man; by experimental farms of a more practical character in charge of a practical agriculturist; whilst cattle-breeding is more particularly attended to in special sheep and cattle farms.

A broad basis of practical usefulness is given to the whole system by the existence of powerful agricultural associations, frequently embracing a considerable proportion of the practical agriculturists and farmers. Their meetings, their journals, the exhibitions and shows organised by them, are the most powerful means for introducing rapidly into practice all new ideas and suggestions.

Thus there exists in Europe an extraordinary amount of agency available for the universal introduction of agricultural improvements, side by side with establishments for the further scientific development of agriculture. No time should be lost in trying to provide India with a nucleus at least, of a similar organisation, having in view both sides of the question—the development of new agricultural methods, and their rapid dissemination, without which success in the first part of the task will only remain a sterile scientific acquisition.

EDITORIAL NOTES.

COOLIE emigration from India to French Guiana is, we see, to be completely stopped, and apparently not without good cause. The official correspondence on the subject was published early in July. It contains a letter from Lord Derby to the Marquis d'Harcourt, declining to permit emigration to Guiana to be resumed on account of the heavy mortality among the immigrants, and the treatment to which they are subjected :—

"I am informed," he says, "by the Secretary of State for India that until a diminution of this mortality can be obtained by the supply of a sufficient number of medical men, and by the provision of hospitals on every plantation and places where a fixed number of immigrants is employed, the Government of India will be unable to permit the resumption of the immigration from that country. With regard to this matter, your Excellency will observe that Her Majesty's Consul states that article 31 of the Immigration Act, to whose stipulations he draws attention, is a dead letter. Your Excellency will also observe that Her Majesty's Consul draws attention to an article in the *Révue Scientifique* entitled 'Les Coolies de la Guyanne,' from which he gives quotations in translation, which gives a sad description of the condition and treatment of the immigrants, and Lord Salisbury trusts that the attention of the Commission of Inquiry referred to in your Excellency's note of the 25th May last will have been drawn to this article by the French Government, and that the Commission will be able to suggest remedies for the evils therein set forth."

Experiments had been made on two estates by a Dr. François, which seem to show that, with proper care and treatment, the climate is not necessarily unhealthy to the coolies. As their labour is earnestly desired, and the French Government have now been made aware of the requirements of the Government of India, there is little doubt that these will be complied with in order that emigrants may again be allowed to go to Guiana.

PROPOSALS have frequently been made to utilise the stems and other parts of hop plants for the manufacture of paper and various textile fabrics, but hitherto they appear to have been turned to little practical account. It is true the stems have often been employed on a small scale in making ropes and similar rough articles, and even carpets have been produced from the bleached fibre, but anything like a general utilisation of the raw material has not, as yet, been attained. We learn from a Wurtemburgh agricultural journal, that a process has now been patented by M. Nördlinger, of Stuttgart, by which the fibre can be rendered sufficiently tractable to enable it to compete with flax on almost equal terms. The stems, etc., are boiled in water, to which soap or soda has been added, for three-quarters of an hour, thoroughly washed, and then again boiled in very dilute acetic acid. The fibres are now washed free, and dried, and when properly combed, can be worked like other textile materials. They are said to resemble flax fibres very closely, and to be superior to all others in elasticity, softness, and durability. It is much to be hoped that this process of employing the stems may prove a practical success, for at present, if the hop itself fail, the crop so tenderly nurtured is little less than a dead loss to the unfortunate grower.

A LONDON correspondent writes, *apropos* of vine leaf disease, that a proprietor of estates in Matale has sent out to Ceylon a considerable quantity of "flower of sulphur," and a number of bellows such as are used in France for applying the powder to the vines: "He told me himself that he had seen the good effect of sulphur applied to the diseased vines, and he felt very confident that it would be equally effectual in curing the *hymillia*. The application of the sulphur dust by means of the bellows is simple and easy, and it would also be inexpensive. The shipment has already left, so that before long this remedy can be put to the test of actual proof."

A CORRESPONDENT writing from Julpigori makes a suggestion :—"What a pity it is that Government does not start a practical farm, in this district. There is plenty of the best land to be had in the Western Dooars, and many planters would take the opportunity of learning a few ways of making the spare land on their estates profitable. The Government could cover all expenses by putting out a hundred or a hundred and fifty acres of tea on the farm. Tobacco, corn, rice, &c., would find a ready sale, if a good road or two were made. And it is probable that if Government opened a farm, they would soon see that there were some means of communication. The high price of rice, and the greater pay offered for road work, are causing a good many coolies to leave garden work."

INDIGO planters may feel interested in the fact that Dr. Springmuhl has discovered a splendid blue colouring matter among the derivatives of anthracene.

AN interesting fact for agriculturists is communicated by Herr Rudolf Mayerhoffer, of Prague, the editor of the agricultural serial, *Der Bienenvater aus Bohmen*. It appears that a German colonist upon the Island of Java has successfully tried the cultivation of the native bee, *Apis dorsata*, which hitherto has been valued by the natives only for the sake of the larvæ. Herr Mayerhöffer even expresses the hope that it will be possible to acclimatise the Japanese bee in Europe.

IN the *Annalen der Hydrographie* there is an account of a group of three islands discovered by Capt. Caller in 1877, on the north-west coast of Australia. These islands, which in their highest point do not rise more than thirty feet above the level of the sea, are covered with a thick deposit of guano, containing an unusual amount of ammonia and phosphates. On account of their nearness to the continent, these valuable deposits will probably play an important part in the agricultural development of Australia.

THE reports of the cotton crop in America show an increase of acreage of at least 3¾ per cent., and the crop is reported to be generally far more forward now than at the corresponding period of last year, and much in advance of any crops in former years. Hence the probability that the early receipts of new cotton will be large. The estimated crop for the season in the United States is 4,750,000 bales—the highest of any year since the Civil War; and with the exception of the season of 1859-60, when the crop was 4,823,770 bales, the highest on record.

A CORRESPONDENT in England writes to us :—"I have just returned from the Paris Exhibition. The Japanese show a fine assortment of bamboos together with articles made therefrom, so also do the Dutch, from Java. In our Indian collection there are a few stems shewn, but they are placed too high for any examination and might as well have been left at home. Now

Congress seems in a fair way of concluding satisfactorily, I hope commercial affairs may make a fresh start, not only in this country but in India."

It was stated some time ago by a contemporary that the proposal to send emigrants from Madras to the Myouktoung farm in the Arracan Hills had been abandoned as too expensive. It does not appear, however, that it was ever proposed to import labour from Madras, but to employ Madrassees from Rangoon. This would of course have been an expensive measure, as the most worthless Madrassee cooly can, it is said, earn Rs. 10 a month in Rangoon, while first class coolies get Rs. 14 or Rs. 15. And yet so far superior is the work of the Tamil cooly said to be to that of the Bengalee or Chittagong cooly, that it appears to be doubtful if he would not be worth the high wages. However, it is unnecessary to employ the cooly who has been accustomed to high wages in Rangoon. Tamil coolies emigrate at their own expense to Ceylon—which is a much dearer country than Burmah—for wages at rates of *6d*, *7d.*, *8d.*, and *9d.*, for the very best workmen per day. It might be inferred that they might easily be induced to go to Arracan at still lower rates. But we believe Chota Nagpore is really the best labour market. Government might easily get from thence very good coolies, who would think themselves well paid on Rs. 8 a month, and their work would certainly be worth far more than the wretched labour obtained locally. In fact, from the information we have received, we might be justified in saying that unless the Government will import good labour (say from Chota Nagpore), it had better give up the farm at once.

The cultivation of the poppy is making rapid progress through the province of Yunnan, and already occupies one third of the entire cultivable area. There is scarce a hovel perched aloft among the mountains that does not possess a poppy patch. For hundreds of miles the Grosvenor Mission travelled through fields of poppies, breakfasted among them, and shot opium ducks for a meal. These birds are partially stupefied by feeding on the narcotic vegetable, and the Chinese affirm that they exercise a soporific influence upon those who feed upon them. Although growing freely "in every kind of soil, from the low sandy borders of the Yangtzu to the rocky heights of western Yunnan," the poppy was found to flourish most luxuriantly in the wide valleys near Tung ch'uan at an elevation of 7,060 feet. Mr. Baber recommends the Society for the Abolition of Opium *to discourage its production in India, if they* desire to give an impetus to its growth in Yunnan. It is, however, no laughing matter for Indian tax payers. For the present, the Indian drug is preferred by Chinese connoisseurs and the wealthy classes by reason of its superior strength and flavour; but the Chinese possess too much skill as horticulturists to fail in rivalling the poppy of Patna or Malwa, and the manufacture of the drug may be accomplished by the Chinese quite as successfully as by the natives of India. In the face of such a formidable competition, the Indian Government should lose no time in setting its house in order, and in preparing for the worst.

It appears there is a project on foot for growing apples in the North-West Provinces on a large scale. In America, in Ohio especially, apples grow in abundance enough to be almost a food staple. "If Kumaon can grow apples like this,' says the correspondent of a contemporary, "why does it not do so on a large scale and supply Bareilly with dried pippins when the local rice refuses to come up? The Commissioner of Kumaon has allotted or is about to allot to the undertaking certain appropriate ground at Ranikhet, and the plantations in the beginning will be managed by the Director of Agriculture. I am not supposing that apples will ever avert a famine. Cakes will not take the place of bread, even at the bidding of a Queen of France, but every little helps, and if Kumaon succeeds in multiplying its apple plantations to such an extent that a considerable export of the fruit becomes possible, so much the better for the neighbouring districts. It is mainly however as an addition to the wealth of the country that all new productive industries are welcome. India is at present importing a good deal of Californian fruit. Even if the Ranikhet plantations are destined to grow for European tables rather than for popular consumption, still it will be a saving to India if an article of luxury now imported should be produced at home, just as it is a saving to brew our own beer."

Some deposits of guano have been discovered on the Islands of Moria and Monito, dependencies of Porto Rico, whence they are about 15 or 16 leagues distant. On the larger of these, Mona, which has a superficies of three or four square miles, it is estimated that from 100,000 to 150,000 tons of guano are accumulated, and on Monito about the same quantity is believed to exist, though this island is of far less size and importance. Both of them are uninhabited except indeed by sundry goats and oxen in a wild state. Last year the Spanish Government granted a concession of the guano deposits to Pärrata, Dazie, and Cantreras, of Porto Rico. An analysis of the guano made in London gives its proportionate composition as follows:—phosphoric acid 14·00 per cent; lime, 13·20; alkaline salts, 4·60; carbonic and sulphuric acids, 5·40; silica, 6·70; water of combustion and organic matter, 34·30; and moisture, 21·80. Another analysis, carried out at the chemical laboratory of the Conservatory of Arts at Paris, exhibits the following composition:—Organic matter, 9·95 per cent.; phosphoric acid, 5·05; carbonic acid, 26·95; nitric acid, 1·04; quartz, 40·27; potass and other mineral matter, 6·34; silica and clay, 2·10; and water, 8·30. The guano is said to be not intended for the European markets, at all events at present, and is likely to be held back till increasing scarcity of such manures shall have induced a considerable rise in prices.

The Americans spend a good deal of money over their agricultural colleges. California receives annually for her agricultural colleges, 45,000 dollars; New York comes next, owing to the management of Mr. Cornell, and the university named after him recives annual interest, or has been in receipt of it, to the amount of 35,000 dollars; the Iowa State agricultural college follows with 34,822 dollars; while Massachusetts, which has been looked upon as possessing the model institution, has had to divide her 12,000 dollars between the agricultural college at Amherst and the institute of Technology at Boston in the proportion of 8,000 dollars to the former and 4,000 to the latter.

We read that the system of removal of the town sewage of Wurtemburg by railway for employment in adjacent agricultural districts, which has been tried on a small scale for some years, has been found to answer so well that it is likely to be largely extended. At Schorndorf, nearly twenty miles from the capital, a large reservoir of masonry has been constructed for the reception of a daily consignment of sewage, which is employed upon the land with most encouraging success. At present there is accommodation for only seven waggon-loads a day, but steps are being taken for the immediate construction of further reservoirs. The expenses are borne partly by the town authorities, who are glad to get rid of their sewage, and partly by the local Agricultural Society, whose members are well satisfied to employ it.

The Agricultural Department has reported on the experiments made last season to test the utility of Messrs. Thomson and Mylne's Sugar Mill. Success or failure has not been absolutely determined by the results; but the mills appear to have met with general appreciation wherever they had a fair trial. A few native proprietors have been induced to become buyers, and the Superintendent of the Terai is reported to have been so satisfied with what he saw of the working of the mills that he proposes buying several for next year's operations. The advantages of the Bihia Mill are simple, that it can be worked at a considerable saving in the cost of labour, and that the juice expressed is undoubtedly of a good quality. The amount of juice expressed is not greater than that of the ordinary native mill, because the cane crushed in the latter is often subjected to a second or third wetting and recrushed; but given a certain quantity of juice in a given quantity of cane, the superiority would evidently lie with the mill that expressed it with the minimum of labour. The time in which a given weight of cane can be crushed appears not less with the Bihia Mill than with the native mill; the accuracy of at least some of the experiments which lead to this conclusion cannot be impugned since they were conducted in the presence of one of the patentees. The price of the mill is prohibitive; an ordinary wooden mill can be put up for from ten to twenty rupees at the outside; a stone mill will cost about Rs. 60 and be an heirloom in a family; the prime cost of the Bihia Mill is Rs. 80, which, without exceptional advantages in other ways, is fatal to its general adoption. It seems probable that it may gradually supplant inferior wooden or even stone mills in the lower districts, but cannot successfully compete with the good wooden mill of Bulandshahr, &c. Further experiments must be conducted to determine satisfactorily the value of the new mill, and the statistics of the results should be given in a form that admits of comparison with results obtained elsewhere. It is not conducive to accuracy to learn that so many "bundles" of cane gave so many "lotahs" of juice.

THE antiseptic properties of creosote are well known to be of the most highly efficient order, but the difficulty of making it soluble to such an extent as to secure its ready and complete mixture with water has hitherto stood in the way of its use as a disinfectant. As our readers are aware, it has been used with the most valuable results as a preservative for timber, and Messrs. John Jeyes & Co., Walbrook, London, have succeded in extending its uses almost indefinitely. Their own experimental tests with regard to its new applications have been careful and severe, but, not satisfied with them, they have submitted it to the investigation of such competent authorities as Professors Redwood, Wanklyn, and others, whose judgment cannot be doubted, and who have pronounced the most favourable verdict, after the most searching analysis, upon the Jeyes' Patent Sanitary Creosote. Everything that promises to extend our power over the forces that operate against the public health ought to receive grateful welcome from all who are interested in a subject which is at once the highest and most universally interesting.

WE quite agree with the *Pioneer* that "something might be done to improve the Vernacular Press by communicating news which should be fresh and genuine, qualities generally found wanting in the *réchauffé* of old telegrams, &c., that now passes for news in native newspapers. Information, agricultural, scientific or even political, might be diffused by the same means; and the Department of Agriculture, till it publishes a report of its own doings, might thus find an easy way of taking the public into its confidence and of fostering an interest in its special work, or even eliciting suggestions and wholesome criticism. There are many native gentlemen with a taste for agricultural experiment who are as yet utterly ignorant where to turn for advice and encouragement, but who might get both through the newspaper so many of them take in. For Europeans a quarterly report of experiments (successful or unsuccessful, even these have their value) of gardens, and proceedings generally, might be useful." The suggestion is a good one—well worthy the attention of the Press Commissioner.

A FACT likely to be made use of by the advocates of irrigation has been noticed by the Collector of Salem, which is that the insects now doing so much harm to the crops in the Madras Presidency, do not attack dry crops raised under wells, and not an insect is to be seen in any of the fine crops of cholum and cumboo in part of the Namkal and Haripuru Division of Salem Taluq.

A SAMARANG contemporary states that the cocoa trees in Menado and throughout the Moluccas have so degenerated from disease, that people there despair of being able to restore that culture to its former prosperity, unless by procuring fresh seeds from elsewhere.

AT a recent lecture at home, Professor Leeds exhibited a new machine for the production of ozone in large quantities and in a very concentrated state. The oxygen, after cooling to zero, was deprived of all moisture by drying agents, and then passed through tubes highly electrified. The ozone so produced exhibited intense chemical energy, bleaching indigo instantly and oxydizing silver. The generation of ozone during the decomposition of water by the galvanic current was also visibly illustrated. If it be true that epidemics of cholera are only prevalent when there is a paucity of ozone in the atmosphere, then it must be admitted that this discovery is a most important one, and may hereafter be productive of great results.

A PRODUCT of the South Sea Islands, called copra, which is the dried kernel of the cocoa-nut, is being turned to a new account. Hitherto it has only been used for making oil, but now it has been discovered that the residue, after that process, is valuable as food for cattle and sheep.

WE learn from a contemporary that Cole's Garden near Mysore is being reclaimed. It is under contemplation to convert it into an Experimental Farm and to utilise the adjoining buildings, known as the New Cantonment, as work-shops, &c., a portion being converted into a pleasure ground. The place is well adapted for the purpose, and when the improvements are complete Mysore will have an institution that is very much needed.

ONE encouraging fact noticed in the annual report on the Nicobar islands for last year is a considerable increase in the number of horned cattle, and a saving of nearly Rs. 9,000 a year in fodder to Government herds in the Southern District, by the issue of Indian corn obtained from the newly-cleared land between South Point and Corbyn's Cove. The Superintendent anticipated that, after supplying all local wants, he would be able, during the current year, to export large quantities of timber.

INFORMATION valuable with reference to pasturage on mountains may be found in the description by the Agricultural Correspondent of the *Madras Mail* of a case of reclamation on Exmoor:—"Many attempts had been made to break up the black peat lands, lying on this obdurate plain, but the operation was so unprofitable that it could not be carried on. At last a simple and inexpensive method was discovered, which has done all that was wanted. This is to plough the land out of the natural heath and grass, to spread about three tons of lime, weighed when unslacked, per acre upon it, and to sow it with rape, which is eaten off by sheep. This is continued for three or four years, superphosphate being sown with the rape in moderate quantities each year, but no more lime applied. The roots of the rape penetrate the peat, and gradually get into the pan, making it at all events less impenetrable, and the treading of the sheep consolidates the peaty top, and they enrich it by their droppings. At the end of the third or fourth year the subsoil is easily broken up with the plough, and the land is sown out to permanent pasture without a white crop being taken. Sheep fatten rapidly on the rape, and the profit from them more than repays the annual outlay on lime and manure. I saw some time ago an improvement of somewhat similar hill lands going on in Westmoreland; but there a grain crop was taken before coming out, much to the deterioration of the pasture afterwards. Wherever your Neilgherry planters desire to improve their pastures, I would recommend them to do somewhat after Mr. Knight's fashion, without the intervention of a grain crop, or of any crop from which the seed is taken."

ETHNOLOGISTS and antiquaries generally will be much interested in Dr. Bidie's report on the Madras Museum, to which some important additions were contributed last year. A very interesting discovery was made at the instance of Dr. Jagor of Berlin. While travelling in India he observed that the potters at Salem communicated to their ware a polish exactly like that seen on some of the specimens of antique pottery found in Tumuli. On enquiry he learned that the Salem potters use a seed for producing the polish, and he carried some of the seed to Germany. There it was found impossible to identify it, as it was bored and strung on twine. A few of the seeds therefore were sent to the Museum by the doctor, and with the aid of Mr. Longley, Collector of Salem, Dr. Bidie was able to get specimens of the tree which produces the seed and found it to be *Gyrocarpus Asiaticus*,—one of the laurels that grows in Salem.

WE learn from Ootacamund that Mr. Jamieson, the Superintendent of the Botanical Gardens, has received an application for the whole of the coming season's crop of cocoa in the Burliar Garden, intended for seed to be raised in Wynaad. We wish the introduction of cocoa into Wynaad every success.

CONSIDERABLE excitement has been caused in the district of Tekuch, near the village of Funder, Roumania, by the sudden appearance of a species of mole, yellowish in colour, 20 centimetres in length and 8 in circumference, of a snake-like appearance, which has already destroyed 120 acres of wheat, part of the ground being cleared so effectually that it is impossible to tell what species of grain had been sown thereon. These animals disappear during the daytime in holes dug in the earth, and come out at night to commence their depredations. The oldest inhabitant of the district has never seen anything of the kind before.

Professor Ingersoll, of the Michigan Agricultural College, has begun investigation of some experimental plots of wheat, to determine, if possible, whether the Hessian fly will attack certain kinds with more severity than others.

The *Montrose Standard* notices the enormous prices paid for deer forests this year. The highest is probably Glenstrathfarar, Inverness-shire, the property of Lord Lovat, and let to Mr. Winans, an American, at an annual rent of something like £7,000, to which must be added the cost of gillies, hill ponies, &c. In Forfarshire there are two valuable forests only. One is Invermark, the property of the Earl of Dalhousie, and let to Sir R. Bateson Harvey, at a rent of £3 000 a year, the second being Caenlochan, belonging to the Earl of Airlie, and let to Sir Brooke Middleton for £1,000 a year.

Two Ceylon planters have gone to prospect Perak as a scene for planting enterprise. From what we have read we fancy the conditions of soil and climate are good. The question is one of labour and of good relations with the kris-wearing Malays.

The North West Government has directed that, for the purposes of rule XXXV of the rules made under the Opium Act, 1878, the value of confiscated poppies shall be calculated at the rate of Rs. 12 per Agency bigha of 3 025 square yards, and of confiscated opium declared to be fit for use at the rate of Rs. 3 per seer. Opium declared to be unfit for use shall be deemed to be of no value.

COMMUNICATED AND SELECTED.

EXPERIMENTAL CULTIVATION OF CUZCO MAIZE IN INDIA.

In the last paragraph of his despatch No. 56, dated 12th November 1871, on the subject of the quinine plant, the Secretary of State informed the Government of India that he had directed two sacks of Cuzco maize seed to be sent out, and requested that on receipt the seed might be distributed for trial in those districts in India where maize is most grown.

The seed was received and sent to the Governments of Bengal and the North-Western Provinces, and to the Agricultural and Horticultural Societies at Calcutta, Lucknow, Nagpur and Bangalore, who were asked to have careful experiments made in its cultivation, and to report the results.

The Agricultural and Horticultural Society of India distributed the seed sent to them to upwards of sixty applicants in the Punjab, the North-Western Provinces, the Central Provinces, [illegible] in parts of Behar, in Upper and Lower Bengal, &c. The reports received from several of the recipients were all to the same effect, viz., that the seed germinated readily, grew well, but did not yield fruit. From Tirhoot, which was considered a good locality for the experiment, seeing that maize was largely grown there, Mr. Stevens of Durbhunga wrote:—

"The Cuzco corn has been a failure; it germinated and grew to a great height, but developed very small cobs, quite barren of grain."

Mr. Francis of Muzufferpore remarked:—

"The Cuzco maize, I am sorry to say, has completely failed. At first it grew vigorously and in my garden it formed a number of cobs, but every plant died off before these had time to ripen. I have received similar reports from all those among whom I distributed the seed. It might succeed better if sown in the cold weather, or about October, but I do not think the climate admits of its being grown as a crop for the rains."

With reference to the above remarks, the Secretary to the Society stated that he sowed some of the seed out of season, immediately on receipt in January, and that the plants became stunted, did not exceed 4 feet, and died down without flowering, whereas the seed sown at the commencement of the rainy season attained a height of 12 feet, flowered, but formed no cobs.

Mr. F. Halsey of Madhopur, Punjab, wrote:—

"I have never furnished you with any account of the Cuzco maize seed. It was sown on the 15th July when the ordinary Indian corn of the country is sown, and germinated freely. By the [illegible] September it had reached the height of 15 feet when the male flowers appeared; at the same time the female flowers commenced forming, and I was in hopes I was going to have a large crop. About a fortnight went by, and seeing no signs of increase in the cobs, I slit up the sheath of the leaf containing it and found the flower was so constructed that the pollen from the male flower could not pass down to the seed bearing portion of the cob. I waited another fortnight to observe the result of my operation, when I had the pleasure of seeing a few seeds form. I then slit open all the remainder, and they all commenced to form seed, but unfortunately the season was too far advanced for the seed to come to maturity. But on the cob I have sowed, I have some dozen seeds which have arrived at full maturity. These seeds, I have little doubt, will bear plentifully next year.

"I cannot say I quite understand the cause of this, except that I have often had trouble the first year with exotic seeds of all sorts; in fact, I may say the produce of imported seed rarely comes to perfection in any quantity during the first season of its introduction. If the Cuzco maize comes from the country its name indicates, I fancy it comes from a high and almost rainless table land of the Andes, and consequently, it is not astonishing that it should find a difficulty in succeeding here. But at the same time it seemed to thrive most extraordinarily during the rains, which this year amounted to 75 inches between the time it was sown and the commencement of October. It has a strong tendency to send out adventitious roots, and if these are earthed up to the height of 3 feet, notwithstanding its inclination to grow so very tall, it is quite capable of sustaining its own weight.

"I am doubtful whether it is likely to turn out a satisfactory description for this country; the village mills are not fitted to grind it and it does not appear to be of a prolific nature, or as inclined to return its seeds as rapidly as many of the native kinds. An English farmer prefers the small round native seed of this country to the horse-tooth American varieties, I fancy because he can get a greater weight per bushel from the former."

Colonel I. H. Chamberlain of Ranikhet, in Kumaun, sowed 150 seeds in well prepared ground in his garden, which is about 5 950 feet above the level of the sea. All the seeds sown germinated and grew to fine healthy plants from 10 to 12 feet high. 118 of these bore exceedingly fine and well formed cobs, and only 32 failed to bear fruit. Colonel Chamberlain had some of the cobs prepared for his table and said that he never tasted anything better of the kind. Colonel Chamberlain intended distributing seed among the neighbouring villages, and to try to get it into circulation for sale in the bazars.

Lieutenant Pogson of Simla stated that the plants raised by him attained a height of from 12 to 15 feet, and that most of them produced seeds. A single grain of the seed raised by Lieutenant Pogson weighed as much as [illegible] of those of the common hill varieties, and an average of 3 cobs of maize equalled [illegible] of those of the indigenous kinds.

Lieutenant Pogson discovered that the stalk of the Cuzco maize was exceedingly rich in sweet juice, which in the plants that had not borne cobs was as sweet and abundant as in the best sugarcane, and that the aroma of the juice and of the cut stalks was also the same as that of the sugarcane. He thought it quite possible that if the 2nd or 3rd set of adventitious roots (some of his plants had 5 such sets, and 3 and 4 were common) were bled or tapped at or after sunset and an earthen pot placed under, the result by the next morning would be a good supply of sweet juice.

The Society reporting on specimens of seed sent to them by Colonel Chamberlain and Lieutenant Pogson, said:—

"The seeds furnished by Colonel Chamberlain and Lieutenant Pogson are about equal in size, though the former appear to be in rather better condition. They are considerably larger than American maize. The cobs in both cases are small as compared to the North American kinds of maize, but whether they are naturally small, or whether they have deteriorated from those raised in their own country, we have no means of judging, as the seed from which this produce has been raised was sent to the Society in a shelled state. It would be interesting to learn whether each stalk of this maize yields in Cuzco more than two cobs. The varieties raised in the United States give only two as a rule, whereas our country maize yields 3 and sometimes 4 cobs. Colonel Chamberlain's best cobs were devoured by rats, so that those sent by him are not the largest."

Dr. Jameson, the late Superintendent of the Saharanpur Botanical Gardens, reported that the seed received by him was sown at Saharanpur, Mussoorie, and Oujauri in the Himalayas. The plants grew with great luxuriance and attained a height of from 10 to 12 feet with stems four-fifths of an inch in thickness. Neither the male nor the female flowers were, however, fully developed and the consequence was that the seeds did not form properly. In some of the cobs 3 or 4 imperfectly-formed seeds were found, but the general result was a complete failure.

The Agricultural and Horticultural Society of the Central Provinces reported that the seed received by them which was sown in a well-prepared plot of ground, germinated freely and grew luxuriantly, but that not a single cob formed. The Society were of opinion that the plant was not suited to the dry climate of the Central Provinces.

Colonel Boddam, the Honorary Secretary to the Agricultural and Horticultural Society of Mysore, stated that he sowed a small quantity of seed early in March, but that as soon as the seeds had fairly germinated, the young plants were all eaten up by bandicoots. Another supply was then sown in flower pots, which were protected from rats; when the seed germinated the seedlings were transplanted. A batch was also sown in rows, but as a protection from rats each seed was covered up at night by a small flower pot. In this way a number of plants were raised, which progressed rapidly, till one night they were all blown down by a storm. A fresh crop was then raised with the same precautions against rats, and each plant was further protected against the wind. The plants progressed, and all went well till one night the garden was rifled by thieves. A very small quantity of seed remained, which was sown, and Colonel Boddam had at last the satisfaction of harvesting a few magnificent cobs. Colonel Boddam intended repeating the experiment during the following year.

Dr. Bonavia, the Superintendent of the Department of Science in Oudh, reported that the seed sent to him was sown immediately after the rains had commenced on soil which had been well ploughed and cleaned and that about two-thirds germinated. Of these, several plants perished from weakness, and 2 851 grew well and thrived. The majority reached a height of 10 feet, but in consequence of their tallness and of their being unprotected, several plants were blown down by the wind, and the remainder had to be supported by sticks. Some of the plants produced one, some two, and some three or more cobs from the same joint. Some of these cobs had their seeds entirely unfertilised; some had only a few seeds fertilized, whilst others, although they had some fertilised seeds, rotted before they came to maturity. The seeds of others began to germinate on the cob before they were ripe, and finally only a small proportion of cobs ripened their seeds. Altogether only 90 cobs, containing about 1,000 ripe seeds, were harvested, but none of these came up to the standard of size of the original seeds. In order to try whether the winter might not suit the Cuzco maize better than the rains, Dr. Bonavia sowed a small quantity of seed on the 10th of October, but none germinated. Dr. Bonavia mentioned that this was not the first time he had experimented with Cuzco maize in Lucknow. In 1862 he sowed some seed, which had been sent to him by Dr. Forbes Watson, but did not meet with any success. Dr. Bonavia said that he had to resort to artificial fertilization, and thus obtained a few small cobs with healthy seeds, but that these were much smaller than the originals.

On the whole, Dr. Bonavia was of opinion that the Cuzco maize was unsuited to the plains of India. He thought that as it came from the dry and cold regions of the Andes in Peru, it might be better suited to the regions beyond the influence of the rains in the Himalayas, such as Chini, Pangi, and other valleys among the snowy ranges, to whose scanty productions it might become a valuable addition.

Dr. King, Superintendent of the Botanical Gardens at Howrah, distributed the seed sent to him to several gentlemen in Darjeeling, Almora, Ranikhet and Assam. The general result was that the experiments made at low elevations, and in hill districts, where, as in British Sikkim, the rainfall is excessive, were everywhere a failure. There was however, some promise of success at elevations of from 5,500 to 7,500 feet in the hill districts of the north-west Himalayas, where the rainfall is moderate.

The following were the details of some of the successful experiments :—

General Ramsay, Commissioner of the Kumaun Division, reported that of the seeds sown by him at Almora, each stalk produced had only one or two cobs, but that these were very fine and long.

Mr. Crossman of Kurseong stated that the growth of the plants raised by him was very luxuriant, and that the cobs were produced in great numbers. Before, however, the maize was ready for breaking, some cattle strayed into the field and destroyed a large number. But for this accident the experiment would have been most successful. Nine pounds of the red and 25 pounds of the white maize were harvested. Mr Crossman intended distributing the seed saved to several planters in the district.

Mr. Craw of Doonagiri reported that the seed sown by him germinated well, and that the plants grew vigorously, but did not flower till late in the season. The healthy plants produced two and three cobs each, and the others only one. Mr. Craw thought that the seed should be sown early, in order to allow the ears to come to maturity before the cold weather could set in. He intended distributing the seed saved in the hills, and sending some to Cabul.

Mr. Mandelli of Lebong, in Darjeeling, said that the result of the first sowing made by him was unfavourable, but that the second was successful. Mr. Mandelli distributed seed to several natives, and to his brothers in the Kutoor valley, and had received favourable reports from all of them.

These results were reported to the Secretary of State in Agri-Horticulture despatch No. 14, dated the 14th August 1876, and it was observed that the experiments made in the plains and at low elevations in the Hills had everywhere proved a failure; but that those tried at higher elevations, such as Simla, parts of Sikkim, Ranikhet, and Bangalore, had been more successful. The Government of India considered that while this variety of maize was not likely ever to be worth cultivating in the plains, there were some grounds for hoping that it might become naturalized in the hills.

Lord Salisbury, in reply, expressed a hope that the Cuzco maize would be naturalized on the high-lands of India, and become a useful additional source of food supply. His Lordship said that the large quantity of sugar which was reported to be contained in the stalks made it possible that it might also become a sugar-producing crop, and he wished to be informed of the results of any experiments that might be instituted with a view to testing this point. He, at the same time, forwarded a note by Mr. Clements Markham on the native habitat of the maize.

Accordingly, Bengal, North-Western Provinces, Punjab, Mysore, and Assam were asked to communicate copies of the despatch and enclosures to the officers and gentlemen by whom the cultivation of Cuzco maize was undertaken during the past year, and who had been fairly successful in their experiments, with a request that they would report the results.

Dr. King stated that he had communicated copy of the despatch and enclosures to Messrs. Gammie and Christison, and remarked that, with regard to the probable success of Cuzco cultivation in India, he was of opinion that, with the exception perhaps of the Punjab, Cuzco maize had no chance of succeeding as a crop in any part of the plains. Concerning the hill districts, he said : "There is abundant experience to show that Cuzco will not grow in the Eastern Himalaya : all maize is grown on the Himalayas as a rainy season crop. In its native valley in the Andes, Cuzco enjoys a climate (Mr. Markham tells us) like that of Italy, and I need hardly say that the climate of the Eastern Himalaya during the rains is not in the least like that of Italy, being hotter and much moister."

In conclusion Dr. King observed that the north-western part of the Himalaya had a much smaller rain fall than the Eastern range, and its climate somewhat resembled that of Italy; and, moreover, the only recorded cases in which Cuzco had perfected seed in India occurred at Ranikhet and Simla. He therefore suggested that if more seed of the Cuzco was to be imported by Government, it should be distributed to Europeans settled in the North-West and Punjab Himalaya, and that the attention of all recipients of seeds should be directed to the value of Cuzco as a yielder both of fodder and grain.

Mr. Freeman, Superintendent of the Shillong Model Farm, Assam, reported that he distributed a few seeds to several of the Khasi cultivators for trial, but had not heard the result, except in two cases, in both of which the seed was said to have failed. He could not understand this, as the seed put down by himself germinated freely, but thought it likely that the young shoots were destroyed by grubs which made great havoc among the ordinary kind of maize as well. The actual result of his experiment was as follows :—

Number of seed sown.	Number of seed germinated.	Number of plants that survived.	Number of cobs bearing seeds.	Total number of seeds produced.
800	800	576	48	666

The cause of failure in the above crop was attributable to the monsoons being far advanced when the corn came into blossom, and this variety of maize required a much longer time to mature than the ordinary kinds, and ought to have been sown a month earlier to enable the blossoms to fecundate before the setting in of the rains.

Mr. Freeman added that seeds of maize should reach him at latest during the month of February.

The Chief Commissioner of Mysore wrote to say that Colonel Boddam left India in June 1876, and from the enquiries made, no experiments seemed to have been made with the seed supplied to him, nor was any portion furnished to the Lal Bagh for trial.

Lieutenant Pogson of Simla reported that the remarkable sweetness of the green stalks of the Cuzco maize and their richness in saccharine juice demonstrated that under ordinary manipulation the expressed juice when strained and boiled down, must of necessity yield an extract resembling sugarcane juice. He said : "The sugarcane differently treated yields coarse sugar, more or less crystallized ; and the Cuzco maize sweet juice would do the same. The unusually dry weather which prevailed from April 1876 to the somewhat late setting in of the rains, prevented my carrying out my cherished project of operating on the Cuzco maize juice for sugar."

Owing to the great solar heat which prevailed, almost all Lieutenant Pogson's plants were scorched up and of the few which survived not one produced seeds. Whether this was due to the soil, or want of fecundation was not known. Lieutenant Pogson suggested that Major Henderson, on special duty at Kashmir (to whom he supplied some seeds of the Cuzco maize last year), should be asked to supply the seed needed for experimental cultivation in Hazara.

Major Henderson, on being asked to supply the Cuzco seed required for Hazara and Kangra, and to report on the saccharine qualities of the stalk, replied that he had been obliged to leave Srinagar before the maize was harvested, and that on his return to Kashmir he was disappointed to find that none of the seed planted by him came to maturity. His *mali* informed him that the cobs bore few seeds, but these were very large. Before they could ripen, the night frosts came on, and the seed was destroyed.

Major Henderson further reported that he had learnt from Baboo Nilambar Mookerjee, Judge of the Chief Court of Kashmir and Head of the Silk Department, to whom he gave about 50 seeds of the Cuzco maize last year, that the cobs of his plants also failed to come to maturity. From the stalks the Baboo made a small quantity of molasses, and conceived so high an opinion of the value of the maize as a sugar-producer, that he recommended the Maharaja to grow it experimentally on a considerable scale. Major Henderson wrote :—

"I am therefore requested by His Highness to submit a request to Government that they will be good enough to procure for him one or two maunds of seed for trial. Should Government be able to comply with this request, I would beg that the seed may be timed to arrive in Kashmir by the beginning or middle of April next."

In continuation of the above letter, Major Henderson again wrote, stating that His Highness the Maharaja had expressed a wish to be supplied with 20 maunds of Cuzco seed at his own expense for cultivation. His Highness also desired before the seed was ordered, to be furnished with an estimate of the probable cost per maund delivered at Sialkot including all expenses.

To this the Government of India replied that if His Highness wished for the seed, application would be made to the Secretary of State who would have to procure it from South America, and that the Government of India could give no estimate of the probable cost.

Mr. Buck, Director of Agriculture and Commerce, North-Western Provinces and Oudh, reported that seed was sent to Colonel Chamberlain and Messrs. Troup and Craw of Ranikhet.

Mr. Craw sowed the seed on a small patch of land at Ranikhet, at an elevation of about 6,500 feet above the sea-level. The experiment was perfectly successful; but as the grain ripened rather late, Mr. Craw thought the crop would not find favour among cultivators, but suggested that it might be favourably cultivated as a food for cattle, and the green plant sold as a fodder.

Colonel Chamberlain distributed some of the seed to European gentlemen residing in various parts of the country, as also to villagers, and sowed the rest himself. But the cultivation was a failure almost everywhere expect at Ranikhet and in the Nilgiris. It was almost proved that Cuzco would not bear any cob below 5,000 feet; that it required a great deal of care; was liable to injury from winds and from its saccharine properties, the plant and flower were frequently destroyed by bears, monkeys, rats, porcupines, parrots, &c. Consequently, many by whom the seed was tried considered it very unlikely to take the place of the common hardy Indian-corn.

The seed produced by Colonel Chamberlain's experiment seemed to be, however, of very fine quality. Regarding its merits and capabilities as a food for man, Colonel Chamberlain said that "this maize is incomparably the finest varieties I have ever seen, and for table purposes there is nothing known to me to equal it." However, Mr. Frank Halsey of Madhopore, in the Punjab, doubted whether the grain would show as great a weight per bushel as the smaller sorts of grain.

Colonel Chamberlain was of opinion that it could be used as most excellent and nutritious food for cattle if it failed as a cereal.

Its capabilities for producing sugar were not tried in 1876 in the North-Western Provinces; but the gentlemen who had undertaken its cultivation in 1877 had been asked to test the saccharine properties of the stalk.

Three thousand of the acclimatized seeds raised by Colonel Chamberlain were sent to the Agri-Horticultural Society of India for distribution on the 25th of June 1877, of which one-half was to be at the disposal of the Government of India, and 2,000 seeds had been distributed at Naini Tal, Mussoorie, the Government farms in the North-Western Provinces, and one or two Government officials.

The seed intended for the Government of India was received several weeks before receipt of Mr. Buck's report, and sent to the Punjab Government for experimental cultivation in the hill districts.

Before replying to the Secretary of State, the further report regarding the saccharine qualities of the Cuzco stalk was awaited. The Government of Bengal was, in the meantime, asked to report the result of the reference to Messrs. Gammie and Christison, referred to in Dr. King's letter, No. 56G., dated the 22nd December 1876, which was received with the endorsement from that Government No. 67, dated the 10th January 1877. (Vide page 6 of this précis).

The Government of the Punjab was also requested to call on the parties who had been supplied with the seed of the maize for experimental cultivation, to report on any success that might have attended its cultivation, as well as on the sugar-producing qualities of the stalk.

The replies from these Governments have now been received, and the following is an abstract thereof.

The Government of Bengal forward copy of a letter from Dr. King, who states that he has not received a report from either Messrs. Gammie or Christison regarding the saccharine qualities of the maize He says :—

"Mr. Christison left India some months ago, and has not yet returned ; Mr. Gammie sowed no Cuzco maize this year, because no seeds were sent to him."

Dr. King had no seed to send to Mr. Gammie : the maize sown in Bengal did not produce any seed, and he was not supplied with any from any other source. As regards the sugar-producing qualities of the Cuzco maize, Dr. King remarks :—

"Sugarcane is very sparingly grown in that (the eastern) part of the Himalayas, and is grown only for eating, not for the extraction of sugar. I do not therefore think that there is much use in trying to introduce as a substitute for sugarcane, an annual plant like Cuzco maize which will not ripen seed in the district."

The Commissioner of Arracan (Lieutenant-Colonel Sladen) to whom some seed was sent for experimental cultivation, was asked to "report on the success that may attend the cultivation of the maize, as well as on the sugar-producing quality of its stalk." He forwards copy of a report from Captain Hughes (the Superintendent of the Hill Tribes of Northern Arracan), who states that seed was distributed to several hill chiefs, and that the result of their sowings, with one exception, was that after germinating and coming up strong and healthy, the young plants rotted away. This result is attributed to the unusually heavy rain which fell in August last. He adds that about one-fourth of the seed was bad, and that he would much like to give the maize another and a fairer trial by planting it on the hills in the month of May, and not during the Arracan monsoon. The solitary instance in which the seed promised to be successful was at the foot of the hills at Myouktoung, where one plant, planted by Dr. Brown, in charge of the Government farm at that place, came up to about nine or ten feet, and then died off, producing only an unformed cob with no seeds in it, but merely a woolly fibrous substance inside.

The Financial Commissioner of the Punjab reports the result of experimental sowings in the Kangra and Hazara districts. He states that the Deputy Commissioner of Kangra received a small quantity of seed from Major Henderson from Kashmir under the name of "American maize,' but that a comparison of the cobs produced showed that the seed was of the same kind as the Cuzco maize supplied by the Government of India direct, though probably of the former year's growth in Kashmir.

The seed was sown in two places in the hills, and at two in the valley ; those in the hills appear to have succeeded better than those sown in the valley, but not one of the experiments was very successful. The Financial Commissioner attributes this failure to the late sowing of the seed and also to the dryness of the season. A few cobs, however, were produced.

In regard to the sugar-producing qualities of the Cuzco maize, it is said—

"The stalk is sweetish to the taste, and sugar could evidently be produced from it, but owing to the small quantity available, the process has not been actually tried in Kangra."

In regard to the experiments tried in the Hazara district, it is reported that in this district also a small quantity of seed received from Major Henderson, besides that supplied by Government, was experimentally sown.

"The seed was sown in fourteen different plots at elevations ranging from 1,500 to 5,000 feet above sea-level The seed germinated almost without exception, but only a small proportion came to maturity."

A comparison of the cobs raised in Kangra with those raised in Hazara showed that in Kangra the plant developed seeds equal in size and similar in appearance to the seed supplied by Government, but the seeds appeared only here and there on the pod ; whereas the cobs produced from the seeds sown in Hazara are like the ordinary Indian maize, with seeds in regular and complete rows, of larger size than Indian maize, though smaller than the Kangra specimens.

The stalk from Hazara was received in too dry a state to judge of its sweetness ; though it is stated that the Tahsildar of Haripur extracted about three chittacks of molasses from about eight seers of the stalk.

The Financial Commissioner is of opinion that the Cuzco maize will grow in the hilly districts of the Punjab ; but owing to the very limited scale of the experiments, the last trial was not conclusive. He considers that manuring would have a good effect. In conclusion, the Financial Commissioners say—

"The double quality possessed by this product of yielding a large edible grain and also producing sugar, renders it worth while to make a further attempt to introduce it in the outer hills of the Punjab."

He would like to have a large quantity of fresh seed in addition to that which was obtained at the last experimental cultivation, in order that a better trial may be made in the coming season.

In the meantime twenty-four and a half maunds of seed were received from the Secretary of State and distributed.

The Government of the North-Western Provinces and Oudh have now sent a copy of the further report promised by Mr. Buck, who gives an account of the general results of the cultivation of the maize during the year 1877 ; the produce of the crop having been used in carrying out the experiments.

"The general results," he says, "have borne out the deductions drawn from the results of cultivation during the two previous years. It seems now to be tolerably well proved that the plant will not do well in the plains, and that the only places where it can be advantageously introduced are the hill villages between the elevations of 3,500 and 7,000 feet."

This seemed probable from the first, as in Mr. Clements Markham's note its habitat is mentioned as being in sheltered villages varying from an elevation of 4,000 to 8,000 feet. The seeds sown in the plains germinate well, and the plant soon shoots up to a considerable height and flowers, but does not form seed apparently from the cause set forth by Dr. Jameson in his report for 1875, which runs thus :—

"The female flowers which are situated below the male have nerve properly formed, nor have the delicate filaments properly developed, which come out of the point of the husk, forming a thick cluster called the silk of the plant. The result was that the pollen from the male flower was lost, and, as through these silky filaments impregnation takes place, the seeds were never properly formed."

During the past year the maize was sown in the plains as Budaon, Cawnpore, and Allahabad, and in the hills at Naini Tal and Ranikhet. At Budaon 300 seeds were sown by Mr. Wyer, the Assistant Collector. The plants quickly shot up to a height of 9 or 10 feet and produced flowers, but no seed. Mr. Wyer attributes the failure to attacks of parrots and squirrels, and to the unfavourable character of the year. Mr. Buck, however, considers that the situation was the real cause. At Cawnpore 800 seeds were sown. The plants grew very high, but were very weakly ; they flowered, but produced no seed. At Allahabad 100 seeds were sown, of which only 23 germinated. The plants, however, throve better here than at other places in the plains. Mr Buck quotes a passage from the report of the Superintendent of the experimental farm—

"The plants grew very strong ; but as they showed no signs of flowering, the centres of 10 of them were pinched off ; 6 of the pinched and 8 of the unpinched ones showed flower in October. This was, however, too late to be of any use, as the weather was getting too cold for the plants to finish fruiting properly Of the 9 (*sic*) plants only 3 produced seed in the cobs. The plants were left in the ground till the 20th of February to see if the seed would ripen ; but, on examination, I found that the seed had all dried up."

At Naini Tal some seed was sown towards the end of July ; seed cobs formed in October, but dried up by the frost. Mr. Buck is of opinion that if the sowing had taken place earlier, a crop would have been obtained. At Ranikhet the maize was again cultivated with very great success by Colonel Chamberlain, the Cantonment Magistrate He sowed about ¼ of an acre with 400 pips, the maize came up luxuriantly and produced over 40 seers of seed (about 38,000 pips) besides 8½ maunds of green stems. The cobs were described by Dr. King of the Royal Botanical Gardens at Calcutta as *magnificent* ; and some specimens were sent to the Paris Exhibition.

Colonel Chamberlain had the cobs dried in the sun after being picked. Mr. Buck therefore thinks that considerable care is necessary to give any hope of success such as that which resulted from Colonel Chamberlain's experiment. He doubts whether the cultivation of maize could ever be attempted with success in hill villages ; for some plants which were raised by Mr. Troup in Kumaon were entirely destroyed by bears.

"Colonel Chamberlain," he adds, "(though justly proud of the success of his attempt, and sanguine of the results to accrue from it), recommends that the maize should be used if possible, to improve the ordinary maize of the hills, by being crossed with it ; the hybrid might be stronger and less delicate, while preserving many of the advantages of the Cuzco variety."

He says that an experimental cultivation will be attempted this year at Chijaun, a garden (connected with the Saharanpur Botanical Gardens), situated half-way down the valley behind Mussoorie. Colonel Chamberlain's garden has been taken over by the Agriculture and Commerce Department, together with all the seed he had (38 seers).

In reporting on the sugar-producing qualities of the maize, Mr. Buck has confined himself to Colonel Chamberlain's report, because he alone had the raw sugar refined, and was, therefore, Mr. Buck thinks, able to give a satisfactory opinion on the quality of the sugar produced. Colonel Chamberlain he says, pressed out 8½ maunds of the stems in a Behea Sugar Mill ; the juice, when boiled down, gave 15 seers of raw sugar or *gurh*. The stems had suffered from the frost before the sugar mill was obtained, and the method of boiling was not well understood, otherwise a larger quantity of raw sugar would, he thinks, have been obtained. The *gurh* was sent to Mr. Powell of the Rosa Sugar Mills at Shahjahanpur, who superintended its refining. There fining resulted in his obtaining 4lbs. of dark brown sugar, and 4 bottles of proof spirit. Mr Powell says in his report that the *gurh* seemed to have been partially burnt in the making ; and Mr. Buck thinks that it is owing to this cause that the quantity of sugar obtained is far smaller than was anticipated.

In conclusion he says :—

"The results, however, have a marketable value, though it seems doubtful whether it would ever pay people to grow Curco maize merely for the sake of the sugar it yields. The quantity of raw sugar yielded by the weight (8½ maunds) of stems pressed is only ⅛th of what the same weight of sugarcane would have given. Of course, the fact must be taken into consideration that the sugar yielded by the Cuzco maize is an *extra* product, an addition to the grain for the sake [illegible] which it would be chiefly cultivated."

THE AGRICULTURAL DEPARTMENT, N.-W. P.

THE Department of Agriculture and Commerce is the latest-born of the many departments which cluster round the local Government of this province. It displays its youthful vigour by a wealth of suggestions and speculations unknown to the traditions of other offices. This exuberance of youth is praiseworthy. The only drawback is that the new-comer is inclined to hand over to the elder departments its schemes in the rough for shaping and polishing. From the Assistant to the Commissioner, each officer of the State has his regular work to do. In most cases if he does it thoroughly it fully occupies his time. He not unreasonably objects to be gadding about in search of answers to questions which an "etcetera" office, however enlightened may choose to throw at his head. On the other hand, the special function of the maligned department is to serve at once as the eye and the useful knowledge repository of the State. It has great capacity for digesting and assimilating knowledge. But it is like a chained-up crocodile, since it can only get such food as is brought to it. The whole executive staff of the country must therefore act as purveyors to the Director of Agriculture and Commerce. They must supply information in sufficient quantities and at regularly recurring periods. If it is hard on them, it is also hard on him. The quality of the knowledge supplied is generally indifferent and often bad. Much of it is not worth the carriage in postage stamps. What else can be expected from collectors and other officials, whose day is wholly taken up with administrative affairs of real importance, and who have no time to find out why Carolina rice is a failure, or why the cultivator won't use an English plough. One of the topics last started by this indefatigable Department is the improvement of cattle and sheep-breeding. It cannot be denied that the oxen and sheep of the Indian ryot are not all that they should be. The ox is undersized and weakly, the sheep is lean, and when made into mutton is bad for the teeth. But then they get little or nothing to eat, and in fact it is a wonder that they even live. The Department, however, proposes to improve the breeds by a judicious infusion of new blood. On the Hissar Farm there are splendid bulls and rams, of sleek appearance and ancient pedigree. These are to be distributed through the districts of the province, and to be at the disposal of zemindars and cultivators. But who is to look after these Government animals, and see that they are properly housed and treated? What security is there that the agricultural classes will avail themselves of the advantages thus offered by a liberal Government? The question grows complicated. The department is unable to solve it satisfactorily. Accordingly a circular is hurled by the Government at the heads of district officers, inviting discussion and suggestions. What the replies will be, it is not difficult to guess. Most of the officers thus interrogated will say they know nothing about cattle; others that no change is required; others that the State should first teach the cultivator to feed his cattle decently before it puts better beasts into his hands. Finally, the proposal disappears into the limbo in which so many specious schemes have been thurst already.—*Pioneer.*

THE STINGING-NETTLE AS A FIBRE PRODUCER.

STINGING nettles no doubt have their uses, and a great many people have maintained from time immemorial that their utility was obvious enough. The stem of a nettle, as any one may know by trying to break one in two, is of a fibrous, stringy nature and it has been urged with remarkable persistency that these fibres were just as valuable for manufacturing purposes as hemp or jute, and in many respects more so, and that in neglecting this weed we are neglecting a valuable source of supply for textile fabrics. From time to time, it is true, the attempt has been made to utilise the nettle, and one or two costly experiments, in the shape of nettle-yarn factories, have been thought to settle pretty conclusively the real worth of the idea; but it is, of course, always possible to attribute failure in any commercial enterprise to a want of judicious management, and the nettle has survived these experiments in the estimation of many persons whose influence at length induced the Austrian Minister of Agriculture to appoint a commission to inquire into the subject. The result of this commission's inquiries and scientific examination of the plant will probably finally settle all doubts upon the subject. It seems that this troublesome and unpleasant item in the vegetable world has one or two highly useful and respectable relatives, and that it has had just that benefit from the connection which the useless and mischievous in the animal world often enjoy. China-grass and ramie are both nettles, and have been very successfully dealt with by the manufacturer. Hence it has been believed that the English weed might be similarly utilised. The report of the commission shows that the Asiatic varieties, though certainly nearly related to the English weed, have certain important characteristics which place them out of all comparison with it, and on the whole it would seem to be their opinion that nothing but loss and disappointment would be likely to result from any such extensive cultivation as has so often been advocated.

PLANTING IN THE TROPICS.

THE British Government is making the most praiseworthy attempts to introduce into its Asiatic dominions the valuable trees of America and Africa, such as the various rubber trees; and, thanks to the invaluable help of the staff of Kew Gardens and its colonial allies, the attempt seems likely to succeed. I shall not dwell upon the important results that may be expected to accrue from such experiments. To bring the horse to the water is one thing, says an Arab proverb, while to make him drink is another thing. From much experience in tropical countries the chief difficulty has always seemed to me to get the interesting strangers planted on a sufficiently large scale to give to their products a commercial importance. You may succeed with plants that give a return in a few years, like coffee, tea, cocoa, cinchona, cocoa palm, but the difficulty is increased enormously with the length of the unproductive period.

In hot climates, however healthy, no emigrant settles with the idea of making the place his home. He comes to make his fortune as soon as possible, the sooner the better, when he can return to his native land. A little gambling excitement, resulting from the uncertainty of the crops, and the fluctuations of the produce-market keeps up his spirits. But abroad no man can afford to embark his small capital in a venture that cannot possibly bring him a return before thirty or forty years—quite a lifetime! So Government must step in for the benefit of the community. Government alone can afford to plant trees, either for timber, or for rubber, gutta-percha, gum, and what not else, and, after having made the planting outlay, pay for the supervision during the unproductive period of growth. Unluckily forest clearing to make room for the new trees, is always a very costly affair, and in the nature of things Government would certainly have to pay more for it than private enterprise, however well the work might be conducted. Besides, for two years at least, there would be a necessity to employ expensive labour to check the natural growth of the forest, or the newly planted trees would soon be choked to death.

Would there be any difficulty in making it obligatory to the Gambir planters, and others, to plant in the last year but one of their occupation a certain quantity per acre of useful trees, and to remit them the ground rent of their estate for these years by way of compensation, so that at the time they cease to occupy their gardens, they would by showing so many trees per acre of a fixed kind two years planted, obtain from the Inspecter of Forests a cheque for a certain sum, which would be accepted in discharge of ground rent, transferable of course? Defaulters might even be found. Such an enactment would, at a very small cost to Goverument, give an impulse to clearing the superabundant forest, and in a few years, at the smallest possible outlay, the State would become the owner of valuable patches of the most useful trees. It would be at least a remedy for the indiscriminate and wholesale extermination of the gutta-percha trees. If grown in dense masses they might be usefully managed by moderate topping, instead of being felled all at one time as now, without any provision for their replacement.

To complete the process, nurseries ought to be made where quantities of the young saplings could be had at a fixed and low price. They ought to be grown large bamboo joints, for easy transplantation upon the principle so usefully employed for the last few years by my good friend Dr. Thwaites, the able director of the Peradenya Gardens, Ceylon. He is, I believe, the originator of it. Such nurseries could be erected by contract near to the clearings. The Chinese, heaven-born gardeners, would certainly take up such jobs very effectually, and be cheaper than any other means.—*F. Van Volxem in the Gardeners' Chronicle.*

AGRICULTURAL PROGRESS IN THE UNITED STATES.

THE *United States Economist* states that Mr. Burchard of Illinois, in a recent speech in the House of Representatives, presented some important statistics of the condition of the agricultural interests of the country that are in a measure surprising. It has been generally known that, not only in the number of acres tilled, but also in the volume of agricultural products, there has been a very considerable increase during the past few years, but few have thought the increase had been so large as indicated by Mr. Burchard's statement. Here are his figures, which he gives on the authority of the census of 1870 and the Commissioner of Agriculture:—

		1870		1878.
Acres cultivated	...	90,771,608	...	121,850,000
Horses ...	...	7,145,370	...	10,329,700
Mules ...	...	1,125,415	...	1,637,[illegible]00
Milch cows	...	8,935,332	...	11,300,100
Cattle ...	...	14,885,276	...	19,223,300
Sheep ...	...	28,477,951	...	35,740,500
Swine ...	...	25,134,569	...	32,262,500
Wheat	bushels	235,884,700	...	360,000,000
Corn	"	1,094,255,000	...	1,340,000,000
Oats	"	247,277,400	...	405,700,000
Barley	"	23,295,400	...	35,600,000
Rye	"	16,473,600	...	2[illegible],100,000
Tobacco	lbs.	250,628,000	...	480,000,000
Hay	tons	24,525,000	...	31,590,000

WELL IRRIGATION AND FAMINE.

THE Government of the North-Western Provinces has been debating the possibility of protecting the country from famine by the systematic construction of wells under State superintendence, and applied to the different Commissioners and other officials for their opinions on the subject. Mr. Carmichael, of the Benares Division proposed that Government should "construct wells gradually over non irrigated tracts; that the land-owners should be made to pay 5 per cent. on the outlay, being allowed to recoup themselves by levying a a water-rate from the tenants who get the water."

But he did not consider the Land Improvement Act under which it was proposed that the "well" scheme should be carried out, was applicable to the North-Western Provinces. He subsequently informed Government that he did not think any improvement would be effected till the matter should be taken into Government hands; that "tracts of country should be selected in one or more districts of a division, funds from the Land Improvement Act placed at the disposal of the Commissioner, and a regular and thorough system of well irrigation should be carried out carefully under his directions," and further called attention to the fact that in the Court of Wards' estates Government made lessees of villages pay 5 per cent. on outlay incurred for tanks or wells, and recommended the extension of this system by legislation.

To these conclusions the Government of the North-Western Provinces in some measure agreed, and received in consequence irrigation proposals from Mr. D. Smeaton, Settlement Officer of Moradabad, from Mr. Wyer, Assistant Collector of Budaon, and from Mr. Ricketts. The concluding portion of the memo of Mr. H. S. Cunningham, President of the Famine Commission, considers the case amply:—

"There are two ways of constructing wells—the voluntary and the compulsory. The first method is the one contemplated by the Government, North-Western Provinces, in their Circular of the 14th November. In order to carry it out, the first step would be to make it easy for the zemindar to borrow from Government the necessary sum for constructing a masonry well: he would then bind himself to pay interest on the sum advanced (probably at 7 or 8 per cent. to clear off the capital loan in a given number of years), and he might be left to make his own arrangements with his cultivators as to the taking of water and the rate to be paid for it. Where the zemindar is a single person, or a united family, this would be feasible enough. Where the zemindars are a large proprietory body, and the village much sub divided among them, it would probably be difficult to carry out such an arrangement. A subsequent letter of the Government, North-Western Provinces, contemplated the compulsory method. Either the well should be built under the direct supervision of Government officials, or the money would be advanced as a compulsory loan to the zemindar to build the well with: he would be compelled to pay 7 or 8 per cent. on it in addition to his land revenue: but in this case, having saddled him with this burden, Government could not, with any appearance of justice, say to him 'you shall make your own arrangement for recouping yourself from the tenants of the lands round the well.' Government must arrange for a compulsory rate to be paid by those lands. But the North-Western Provinces Government has already, it is understood, pronounced definitively against compulsory rates in the case of canals, and I do not see how the two questions can be treated differently, or what arguments can be used for compulsory rates in the case of wells which do not apply equally to the case of canals. This consideration seems fatal to the proposal made by Mr. Carmichael and approved by the Government to give compulsory loans unless the Government has altogether altered its policy. Supposing this to be so, what would these compulsory rates amount to? Here the relation between the cost of the well and the area irrigated becomes important. In Mr. Wyer's case where a well costing Rs. 40 , irrigates 10 acres, each acre would have to pay about Rs. 3 a year for water rate, which in the case of many crops and many soils would be prohibitive. In Mr. Rickett's case where a well costs Rs. 620 and irrigates 10 acres, the annual interest, say Rs 45, would not fall much over Re 1 per acre, and would be quite bearable if the land is dry. But it must be made a compulsory rate. In the case put by Mr Smeaton, where the land is irrigable by *kutcha* wells already, it would be very difficult with justice to impose an additional rate if the fields already pay a wet-rent.

"Of course it must be understood that these figures apply only to the interest on the cost of constructing the well. The cost of raising the water is over and above this, and that cost would almost always be greater than the cost of applying canal water. But I am not comparing canal irrigation with well irrigation, the hypothesis with which I start, is that the construction of wells by Government would only be contemplated in tracts where no canal runs, nor is likely, as far as we can foresee, ever to run.

"If the loans for the construction of wells are to be compulsory, or the wells are to be constructed at Government expense, the cost thereof being made a lien on the land, it will be necessary to obtain legislative sanction—(1) to make the principal cost repayable by the zemindars of the village jointly as a body, or by the particular owners of that part of the village which the well is expected to irrigate; (2) to enable them to recover the interest on that principal by imposing a rate on the cultivators of all the fields which, it is estimated, can be irrigated from the well. This estimate must, it is presumed, be made once for all beforehand; for if each cultivator were allowed to prove that his field could *not* be irrigated from the well, there would be ceaseless litigation. If the loans are to be voluntary, and all that is needed is to relax and alter the provisions of Act XXVI. of 1871, and the rules made under the Act, then, what is necessary would be, I suppose,—

"(1) to provide for the making of advances, the principal of which is not to be repaid in lump, but the annual instalments are to cover principal and interest;

"(2) for the redemption of such advances at the landowner's will;

"(3) to legalize the action of Government in carrying out works for this purpose and for superintending, repairing, &c.;

"(4) to arrange by whom and how the interest is to be paid.

"It will perhaps also be necessary to provide that rent shall not be enhanced on a tenant, nor revenue on a landowner, for certain periods of time, or under certain conditions, in consequence of his having built a masonry well at his own expense.

"There are thus certain obvious difficulties in the way of the project; but if it is possible, as is shown in Mr. Ricketts' memorandum, to make a well, which will irrigate more than an acre a day, for about Rs. 625, we seem to have at hand a means of irrigation, which ought not to be left without thorough investigation. Taking the interest at 5 per cent., we have, for a yearly charge Rs. 30 put, according to Mr. Smeaton, 50 acres beyond the risk of famine. Is this charge of less than Re. 1 per acre more than such a protection is worth? If not to what portions of the country is it applicable? What is the best arrangement for carrying out the employment of State funds upon it? Ought the Government of India to take a project of such general importance in hand, or to leave it to the chance of being worked or overlooked by the Local Administration. Ought the Revenue, Agriculture, and Commerce Department to deal with it for the whole Empire?"

AGRICULTURAL EDUCATION IN MYSORE.

AGRICULTURAL education in Mysore is a subject we have repeatedly handled, and though the country may soon pass beyond British administration, we believe Government should still make some effort for the welfare of the ryots, though the reform be initiated but at the eleventh hour.

The childish way agriculture has been played with by our Government hitherto, has naturally caused many to consider it incapable of improvement. At one time seeds are distributed to the ryots, who, fearing something behind the scenes, are naturally averse to an innovation which is not clearly to their advantage. The mere fact of giving, seems to them to indicate a trap, and we do not wonder at failure. Then we try if the example of a cavalry officer growing flowers will not induce the ryots to alter their customs, and turn from continuous cropping with grain to grow—well we know not what—perhaps geraniums. Next a large amount of money is spent in purchasing land for an experimental farm which is left to grow endless weeds until a trained man is obtained from England, and when this gentleman arrives, he is forbidden for a long time to learn what he has to improve, and exhibits the absurd spectacle of a man ordered to grow within a walled space an improved description of a crop he has never seen. It is astonishing the failure has not been greater, for how can a ryot who has grown a tropical crop from boyhood have faith that a man who has never even seen it should know more about it than he does? We fancy he must mutter the Canarese proverb corresponding to teaching our grandmother to suck eggs.

The latest idea of the Government shows but little improvement on their former ones. Mr. Harman is to select areas of land in the different districts for model farms, which are to be managed by the local village officers. How they are to acquire a knowledge of scientific agriculture greater than their compeers we are at a loss to discover, unless Mr. Harman as he tours about the country exhales the principles of bucolic science while he acts the part of a strolling cheap jack—"Walk up ladies and gentlemen and see a real English plough, which you have but to buy to make your fortunes."

But seriously, are such measures as these a credit to an enlightened Government of the nineteenth century, whose country has just been visited by one of the most fearful famines on record, which there is a strong suspicion, is caused largely by our neglect of agriculture? Have our Government no knowledge of what contemporaneous governments are doing to disseminate sound agricultural practices, that it is satisfied with such puerile attempts as these we have mentioned? If we look at America we shall find almost each State with its agricultural college, its agricultural class in the village school, and its department to initiate and carry out well considered experiments. If we turn our glance eastward to distant Japan, whose agriculture is in some respects the best in the world, we should find her still going onward and understanding that the welfare of the agricultural class means the prosperity of the nation. If we look to war-stricken Roumania we may note a State budget for agricultural instruction, but in India only we see inaction.

Our late Chief Commissioner was notoriously averse to change, but in Mr. Gordon we hope to find a ruler who will not permit such callous indifference to the interests of the ryots. We believe Mr. Harman is urging the necessity of a proper educational policy and we trust he may be successful. We should like to see a school where natives of this province could be instructed under properly qualified officers, to be in their turn instructors and managers of district farms; where the owners of land may learn the duties as well as the pleasures of ownership; and where the sons of our few remaining better class ryots could be taught to emulate and excel their fathers. As education is now conducted in this province, all the clever minds are drawn away from the plough to find themselves but too often unable to obtain a livelihood by the pen. Let us give such youths an opening for their ambition by agricultural training, and they will be of more use to themselves and to the State than jostling each other for the petty clerkships now their highest ambition.—*Bungalore Spectator.*

HYBRIDIZING.

CROSSING and hybridizing are terms often and incorrectly used to express the same thing. Crossing takes place between varieties of the same species, while hybridizing should only be applied to the operation as applied to plants of different species. The latter are very often infertile, and cannot be propagated by seed.

Whoever would experiment in this matter must have some knowledge of the structure of flowers and be a close observer. The production of a cross or a hybrid is effected by fertilizing the pistil of one plant by the pollen of another plant. To understand this simple statement requires a knowledge of flower structure that many have never acquired. In every perfect flower there are two sets of organs engaged in the production of the seed. A flower of the grape will serve to illustrate. The bottle-shaped central body is the pistil which contains some minute greenish pulpy bodies which may become seeds, but which will never mature into seeds unless they receive some influence from without, in other words, they must be *fertilised*. In the grape there is an abundant provision for fertilising the pistil in the bodies which surround it. These are the stamens, each of which consists of a two-lobed pouch upon a stalk. This pouch is the anther and the stalk the filament. When the flower is fully developed, each half of the pouch or anther cracks open by a slit and lets out a fine yellow dust, the pollen. Unless this pollen, or that of some other grape, falls upon the proper part of the pistil, which in this case is the flattened disk at the top, it will produce no seeds. It is not necessary here to state what is known of the way in which fertilization takes place. Practically there must be a pistil to be fertilized and pollen to fertilize it. In the grape these are both provided in the same flower, in Indian corn one set of flowers has the pistils and another set the stamens which furnish the pollen. In the hop, spinach, and others, the pistil-bearing and pollen-producing flowers are on different plants The grape was taken as an illustration, and let us continue with that. In the ordinary course of things the pollen will fall upon the stigma and fertilize it, or if the pollen of this flower is not quite ready to be scattered and the pistil is ready to receive it, the pollen from another flower close by may fall upon the pistil and complete the work.

Now to cross this grape, which we will assume to be the Muscat, with another, we will say the Black Hamburgh, we have to attend to three things: We must prevent this flower from being fertilized by its own pollen; we must bring to it the pollen of the Black Hamburgh, and, after applying this, prevent any pollen from another Muscat flower being brought by winds or insects to this pistil. The petals of a grape flower fall off as a little cap; when this is about to fall off it is removed, and all the stamens before they have shed their pollen, are cut away. Some are so expert as to be able to pinch them off. This prevents the flower from fertilizing itself, and is done early in the morning. In practice several flowers on a bunch are prepared and all the rest cut off. The pollen of the Black Hamburgh must be at hand. This is collected from the flowers of that variety by holding a sheet of paper under the flower clusters and shaking them. When the day is warm and the air dry, pollen in great abundance is shed by the anthers. The pollen when collected is carefully preserved in a small bottle or, if not to be kept long, in a paper. Grape pollen will keep in good condition for some weeks, and that of other plants has been known to preserve its vitality for months. The maturity of the pistil is known in the grape by the moist appearance of the stigma, as that portion which receives the pollen is called; and by means of a camel's hair brush some of the foreign pollen is placed upon the stigma, and then the flowers that have been thus operated upon are inclosed in a muslin bag to prevent insects from bringing other pollen to them, as this might interfere with the action of that already applied. This is the briefest outline of the manner of crossing or hybridizing the grape. If a novice wishes to try the process upon some other plant, the first difficulty he will meet with is that the flower is quite different in appearance from the grape, and he is at loss to discover the parts that appeared so plain in the grape flower.

All flowers are constructed upon the same plan, but the variations in carrying out the details are truly wonderful, and unless one knows the variations of which all the parts are susceptible he will be puzzled. Compare the potato flower with the grape flower. In the grape the stamens are longer than the pistil, and stand out from it, and the filaments are long in comparison with the anthers. In the potato the stamens are shorter than the pistil, and are crowded close to it, the anthers which in the grape were small, are here longer than the filaments, and instead of opening by a slit to let out the pollen, it makes its escape through little holes in their tops. Here are all the parts that are in the grape flower, but wonderfully modified. Another variation is the lilac. Here the novice will be puzzled to find two stamens only, and these stuck fast to the tube of the corolla. A mere outline of the matter can only be given here, but enough has been said to show that whoever would undertake artificial fertilization must give some thought to the matter. The whole subject of natural fertilization is full of interest and abounds in curious facts and is worthy the study of any intelligent person, even if he does not wish to make any practical use of the insight he may gain of the working of Nature.

It may be mentioned here that a French florist has found it to be a great aid in his fertilizing operations to touch the stigma of the pistil with honey, and by thus doing his success is much more uniform than before. It is probably that the honey serves to retain the pollen until the stigma is ready to receive its influence.—*Country Gentleman's Magazine.*

THE COIMBATORE DISTRICT.

LETTER from A. Wedderburn, Esq., Collector of Coimbatore, to H. E. Stokes, Esq., Secretary to the Madras Board of Revenue, dated 31st January 1878.

I have had the honor to receive Proceedings of the Board of Revenue, dated 21st December 1877, No 5,813, requesting me to offer further remarks on a point, *viz.*, diminution of area of grass lands, noted in Mr. Robertson's report on Coimbatore during his tour in the early part of 1876. I regret that he did not show me his report before submitting it to Government, as I might have offered observations on some statistical results which would have given a more favorable opinion of the agricultural prospects of the district than he has done. As the subject of the agricultural condition of Coimbatore is of great interest, I trust I may be allowed to make some remarks on Mr. Robertson's report.

2. Coimbatore is a district originally unfavored by nature for agriculture as regards climate and soil, and such agriculture as is most successful is the result of much labor and expense. With the exception of cotton and tobacco, it exports almost no produce, and the harvests are mostly consumed within the district. It has, now that the weaving trade has declined, no manufactures to speak of, and its rainfall being small there are no large reservoirs, and the total land irrigated is only about 4 per cent. of the cultivated area. Much has been made of the existing sources of irrigation. The rivers, Bhowany, Noyel, Ambravutty, and Auhar are admirably and fully utilized. The largest cultivation is from the Bhowany, and it is necessary to divide the land commanded by the channels so as to ensure only one crop being enjoyed by all; and from deficient rainfall often the supply runs short.

3. I shall notice *seriatim* the defects pointed out by Mr. Robertson, and state the measures taken by me to counteract or alleviate the same during my tenure of office as collector of this district for the past ten years.

4. Paragraph 9—*The prevalence of Prickly-pear over uncultivated land and Village-sites.*—In 1868 and 1869 I offered for cultivation portions of village-sites which were overgrown with prickly-pear, the harbour of snakes and of all uncleanliness; more recently I proposed, and Government approved, that arable land covered with prickly-pear should be let on favorable tenure so as to induce persons to clear and cultivate it. I found in practice that this was the only way of permanently eradicating this noxious vegetation.

Result.—A very considerable decrease of such vegetation has taken place, and land on which it formerly existed is now covered with thriving crops. It was generally on some reserved land that this pest prevailed, such as borders of tank-beds and bunds, road-sides, and village-sites.

5. Paragraph 10—THE ABSENCE OF TREES—*Deficiency of Trees and its Cause.*—There being only 5,000 acres under plantation, Mr. Robertson states that "though the climate of Coimbatore is not favorable to the growth of trees, there are no difficulties to be encountered that cannot be overcome by the expenditure of a little labor which the ryots could afford in the slack time of cultivation." Mr. Robertson was not in the district during the high hot winds from the west which sweep over the elevated plains from June till September. The surface soil is thin and the sub-soil of rock is most inimical to the growth of trees even when established, but more than all Mr. Robertson has overlooked the initial expense of forming a plantation.

6. *Expense of Plantations.*—With no adequate rainfall for months artificial irrigation from wells is a necessity, and the expense of that irrigation he refers to further on in his report.

7. If a tree has to be watered by an expensive process for half-a-dozen years, it becomes a very costly product; and in general trees are a result and not a cause of a permanent rainfall. There is no difficulty in growing them on the Western Coast where the rainfall is heavy.

8 Paragraph 11—*New Plantations in the District.*—The suggestion that Government should establish a number of camping topes has been anticipated. Within the last five years, and to the extreme extent to which funds were available, and lately even beyond it, there have been established topes at all the chief stations where they can be properly supervised by European Officers. Unless a plantation is under constant interested supervision, it becomes neglected and dies. To irrigate these plantations, wells were dug and bullocks kept to raise the water, which expense has been greatly reduced by an improved and economical mode of raising water which will be noticed further on.

The extent of new topes planted from 1871 to 1877 is acres 646, and the number of trees planted 15,720, besides 186,740 palmyras. Existing in public topes, trees 83,451, besides 231,807 palmyras.

9. Paragraph 12—*Alleged Clearance of 700,000 Acres of Scrub Jungle and coarse Grass land.*—It is admitted that there has been a clearance of scrub jungle on the outskirts of cultivation since 20 or 30 years ago, but

this land, in reality about 100,000 acres, was cleared for the purpose of being cultivated with cereal crops; and such cultivation, however it may have partly affected the average rate of assessment of dry land per acre, has largely increased the food supply of an increased population. One of my predecessors thought he could not too much encourage the clearance of unhealthy scrub jungle. It is now for the past ten years no longer done without the approval of the Forest Department.

It will be shown further on that this estimate is exaggerated greatly.

10. Paragraph 13.—The clearance is stated to have amounted to 700,000 acres and to have produced a diminished rainfall. Mr. Robertson does not state the locality where streams once flowed which are now dry, so I cannot enter upon this most interesting point.

11. Paragraph 14—*Diminished Rainfall not shown by the Register.*—Rain registrations do not show a diminished rainfall, but it is alleged that the rain gauges are kept in well-wooded parts of the district. This I can in no way agree to. There is no forest and scarcely any trees before I made a tope at Sattiamungalam, or at Bhowany, Erode, Collegal, Caroor Dharapuram, Pollachy, Oodumulpettah, Palladum, and even in Coimbatore town, till I planted about 3,500 trees in its immediate vicinity; there was not a tope within a mile of the Huzoor Cutcherry where the gauge is kept. That the rainfall has been diminished may be the impression, and certainly there is a cycle of short rainfall every ten or twelve years, but the disturbing elements, whatever they are, affect the periodical rains of the two monsoons, and are more or less general over the Presidency.

Rain deficient in former years of the Century.—In 1845 the deficient rainfall was considered to be an obstacle to the cultivation of an improved cotton, and a part of the district in the Palghaut gap was recommended by Mr. Wroughton, the Collector, as advantageous for the experimental cultivatioan of American seed.

Cotton does not require much rain, and this may be taken as a proof that the rainfall has not greatly altered. In Dr. Buchannan's travels in Mysore he alludes in 1800 to defective rainfall for six years in Coimbatore and short crops.

12. *Cause of deficient Rain*—Coimbatore has the disadvantage of being shut off from the south-west monsoon by the Nilgiri range of mountains which turn the clouds, and even on these mountains the rainfall diminishes from a fall of 150 or more inches at the Koondahs on the west to a fourth on east face of the range.

Consequently, only half of one taluq on the west, in the Palghaut gap, gets the benefit of the western rain, and the hilly parts of the Collegal Taluq on the north attract clouds which have passed over part of Mysore territory.

13. Paragraph 18—*Well Cultivation*—Mr. Robertson admits that the ryots have sunk wells, but adverts to there not being over 200,000 acres so cultivated, leaving two millions of acres untouched by such improvement. As the cost of a well is at least about Rupees 100 on each acre so irrigated, it will be admitted that £2,000,000 sterling is not a small sum to have been sunk in the land by a race of cultivators more than half of whom do not pay 12 shillings annual rent for the ¾ of a million acres they cultivate. The next largest class of cultivators pay from £1 to £3 of annual revenue; only 7 per cent. pay over Rupees 30. I doubt if such small farmers in any country could invest larger sums than £10 an acre or more extensively than this industrious people have done. Having known India for thirty six years I can see progress and hope where a person fresh from England sees only penury and stagnation.

14. Paragraph 19—*Unsanitary condition of Villages.*—Coimbatore town is now a model of sanitation, and the example has been followed in the other Municipalities of Erode and Caroor. At my suggestion village sanitation has been greatly promoted by the local Fund Board, cinerators have been built in most of the large villages, scavengers entertained, and trench latrines provided. The other cusbah towns are being improved in this way, *viz.*, Sattiamungalam, Bhowany, Pollachy, Oodoomulpettah cusbars, and vilages, such as Singanalloor, Mettoopolliem, &c. Sanitation is slow but progressive. It *altogether* depends on the personal interest taken by the higher officers of Government.

15. Paragraph 20—The water-supply has also received attention.

16. Paragraph 21—*Difference noted in prosperity between irrigated and unirrigated Villages*—The irrigated villages are better off than the unirrigated owing to the better condition of those fortunate enough to possess Government irrigated land A cheap supply of water makes the sole difference.

17. Paragraph 22—*Small Crops on the irrigated land.*—The yield of the dry crops in the year of Mr. Robertson's visit was small, and it never from the nature of things—bad rainfal and this soil—could have been much otherwise.

18. *Irrigation of the District from Rivers. Tanks, and Wells.*—It would be most desirable if the irrigation of this district could be permanently increased. The Cauvery river is below the level and only irrigates a small portion of the lowest part adjoining the Trichinopoly frontier. The proposed extension of its irrigation by a weir at Nerunjipett was not found to be a hopeful undertaking after it had been professionally examined by Captain Mead, R. E, some years ago. The Bhowany river scarcely suffices for the crop season. The Ambravuty river some time fails, notably last year, and further drafts on it by additional anicuts are forbidden in the interest of existing irrigation. The Noyel river is exhausted long before it joins the Cauvery.

Some high floods may no doubt reach the Cauvery from the rivers which drain into it, but those freshes are exceptional and *very* short in duration. As a rule it does not pay to construct storage for an uncertain supply or for an occasional flood.

19. Paragraph 28—*Lavish use of water by cultivators under Government irrigation.*—The waste of water is being prevented as much as possible by the construction of masonry sluices; improvement in this is continuous. There is however no real waste of water as it all falls into the line of irrigation,

20. Paragraph 44—*Improved value of Government irrigated land.*—The value of irrigated land has, as Mr. Robertson states, greatly increased. He states that from Rupees 200 to 250 an acre have been paid for irrigated land when dry land adjoining it only commands Rupees 8 or 10 an acre.

In these remarks I perfectly agree; the water is the one thing needful. I have known irrigated land good for two crops, near a large town, fetch Rupees 700 an acre. The improved value of this land is not owing to any expenditure of the owner, and I have therefore, on the revision of assessment, recommended an increased assessment on the double-crop irrigated land which unfortunately is but limited in extent not exceeding 16,000 acres.

Lands with permanent double-crop irrigation may be further taxed.

21. Paragraph 45.—*The Well Lands of Coimbatore.*—The actual area of land under wells is 178,000 acres.

Extension of Well irrigation most important and continuous.—The extension of well cultivation is of vast importance to this district. Indeed I known not of any practical improvement of greater value. Advances have been given to ryots from Government money to sink wells, but the reason why such advances are not more availed of is that the ryots fear the compulsory mode of collection of the advances. They would rather pay a higher interest to the Native money-lender who is not so peremptory in requiring annual instalments of the principal, and it is easier dealing with a Native money-lender in their village than waiting about cutcherries and answering all sorts of questions

22. Paragraph 52.—Mr. Robertson thinks that there is but little probability of there being a large increase in the number of wells so long as the sinking of a well is attended by risk of loss, but wells have progressively increased. No doubt the best sites for them have already been secured, but when I investigated the subject six years ago, in 1871, I found there was an annual average increase of about 596, which, at Rupees 300 a well, would represent an investment of Rupees 1⅔ lakhs annually.

The increase dated from the year 1853, when the policy of not taxing land for improvements by private capital was affirmed in this district, and in 1864, the old well lands were reduced in assessment by Rupees 2.63,000. Thus an improved policy has in itself led the way to improvement.

23. As wells are generally sunk through the hard rock, I do not anticipate much advantage form boring augers; the rock is removed by blasting and tons of gunpowder are annually expended in this work.

24. Paragraph 60.—*The improved Water-lift.*—This, of all the improved machines at the Government Farm at Madras, struck me some five years ago as the most efficient and useful improvement that can be introduced into this district. The successful results have induced me to persevere in this direction, and now there are twenty of these machines in actual use on the Government plantations and ten under construction; under no other circumstances could we afford to irrigate plantations. I introduced an improvement in the draft of this water-lift, making it easier for the bullock. It is my firm belief that, if these lifts were more fully adopted, (some private persons have already adopted them), there would be a great saving in cattle labor and expense; and a permanent advantage to the country. The expense of well-sinking must always be the same, but if water-lifting is halved in expense, the profits must be of course greater, and there will be greater surplus of fodder for the less number of cattle that need be kept, and consequently they will be in better condition.

25. *Breed of Cattle.*—It is not a new breed of cattle that is wanted; that of North Coimbatore is excellent, but more food for them. No cattle can surpass the municipal bullocks, which are fed on green fodder and are of the ordinary breed.

26. *Improvement by Order.*—Mr. Robertson thinks that we ought to influence the ryots by orders regarding the cultivation of their land, and prevent them from impoverishing it; I, on the other hand, think that an inducement might have been held out by special loans to ryots to adopt the improved lift; we offer pecuniary inducement to improvement in the Education Department; the cultivator and land-owner are very conservative and indisposed without some inducement to adopt any new thing. No doubt in time they will adopt the new lift, but the measure might be hastened and advantage reaped by such inducement. It is most painful to see the anima torture inflicted in this country by driving a pair of wretched cattle down a slope, the yoke pressing unequally on galled necks and then the poor creature dragged up backwards to make a fresh start with a refilled bucket. Contrast this with the bullock on the platform of the improved machine, walking quietly round with little apparent effort—then reversing and turning the wheel or drum the other way and maintaining a perfect condition. Having had personal experience of this system for several years, I can testify to the undoubted economy and efficiency of the improvement. I enter fully into this detail as it is one of really the very first importance as regards well irrigation which, again, is the only way in which a failure of water for crops can be prevented

27. *Increase of Land under Occupation with decreased Assessment.*—As regards the large apparent increase (45 per cent.) of dry assessed land, I have to offer the following observations:—

A comparison of the area under dry occupation between the years 1857-58 and 1874-75 shows an increase of 700,000 acres. But this increase includes the following items:—

		Acres.
The first item of 43 per cent. of the increase.	Paravapillocvary grass lands held at quarter assessment taken up on putta, and charged with full assessment	300,000
The second item or 10 per cent.	Acreage increased 10 per cent. by survey, but assessment unchanged, thus lowering the nominal average assessment ...	71,000
The third item or 14 per cent.	Clearance of scrub-jungle, about very lightly assessed at, say, 6 As. per acre	100,000
	Total 67 per cent.	471,000
	while the balance	229,000

or 33 per cent. is doubtless the outside village fields taken up. It does not follow that all this land, which is indeed extra to that formerly rated as dry, is annually *cultivated* or not allowed a fallow. The difference is that when a large amount of land is permanently held on puttas, any fallow is then at the ryot's and not at Government expense, as it used to be when the ryots took up and resigned waste lands at their pleasure without the usual formalities of durkhast and razinamah.

28. If then the above analysis of the increase of the dry holdings is adopted we find that there is not a real increase of 45 per cent. of land in actual cultivation or which has been reclaimed from scrub-jungle, but only that amount in permanent and fully paid occupation which there is no reason to suppose is invariably under the plough or denied the usual restorative fallow.

29. *Decrease of average Assessment by the occupation of lower assessed Lands.*—As regards the statement of Mr. Robertson that the average rent of the unirrigated land has decreased nearly 30 per cent. in the last 18 years owing to the large addition to the unirrigated area of inferior land paying a low rent, I beg to observe that Mr. Robertson has not apparently taken into consideration that in the year 1864 an extent of 158,000 acres, assessed at Rupees 4,86,000, were transferred from "Garden" to the head "Dry" with a reduction* of assessment amounting to Rupees 2,68,000. Further, an extent of 71,000 acres was by survey found in excess of old Pymaish areas and entered in puttas in Fasli 1280, 1281 and 1282, with no increase in assessment. These two facts reduce *pro tanto* the average assessment.

Reduction of assessment.

* A percentage reduction of 13 on the then dry land assessment.

Excess land not charged.

30. *Increased Holdings, a proof of prosperity.*—The fact that the village lands are now entered in permanent holdings instead of being taken up and resigned periodically as was formerly the practice shows that land has acquired a greater value on account of the increase of population, that it is more in demand than it was before, and that the people are better able to pay for it than they were before,

31. The land reclaimed from jungle is productive but it is low assessed, about 6 annas per acre, and this reduces the average. The permanent taking up of the less assessed village lands for occupation does not prove that there is a continuous cultivation of such land, but that if they were not held in putta by one man they would be applied for by another. In fact it is an increased occupation of land. All these causes combined show an increased occupation at a decreased rent. The increase in puttas during the twenty years under reference is only 17 per cent., while the increase in land occupied is 45 per cent. As a rule, all the best lands are first occupied in every country, and as population extends, the inferior and more distant lands come into ownership instead of being left waste.

We have only to suppose a similar case of coffee planters settled in a large district in few numbers and with plenty of land on all sides to take up when needed to extend their cultivation. It would pay them better to cultivate and work out a peice of land and then take up another, if they paid only on their cultivation, but if rivals appeared, they would extend their applications for land so as to include in their holdings the largest amount they could profitably cultivate and pay for. The same argument holds good with ryots when land is so much more sought after than it was thirty years ago.

32. *Alleged reduction of Grazing Land.*—If there were a natural sward of rich grazing land on the plains of a district it would be a pity in the interests of grazing that such pasture should be broken up, but when Mr. Robertson during the dry weather finds that uncultivated land on the plains does not grow grass, nor even weeds, it is evident that not much is lost by the occasional cultivation of such poor soils. In fact, something is rather gained by ploughing the hard surface of sterile soil which facilitates absorption of rainfall, and the stalks of a grain crop are something to fall back upon in the dry weather, when the natural grass, if any, would be entirely burned up.

33. *Chief grazing Lands.*—The chief grazing lands for the cattle of the district are in a part of the district never visited by Mr. Robertson. Mr. Athol MacGregor was the first who drew my attention to the fine cattle and grazing grounds of the north of the district, which I fully visited in 1873.

34. *Increase of farming Stock.*—The increase of ploughing cattle in twenty years, which is probably underrated, is about 50,000, or an increase of 16 per cent.; if this be relied on, it does not favor the idea that 45 per cent. increased land is annually cropped, or even more than a third portion of it.

35. The conclusion we come to is this; that the whole increased acreage under occupation is not under constant cultivation, though it is held in permanent occupation.

36. Thus the gloomy view that while more land is cultivated fewer cattle are kept and, consequently, that there must be less manure and more exhaustion of the soil is open to reconsideration.

37. The fact is that the ryots are now so much better off that they extend their holdings and permanently retain them, instead of resigning and letting them lie fallow at the cost of Government.

38. This used to be greatly the case, and it was matter of lament that the cultivation should be so shifting, permanent puttas were naturally and properly thought a sign of prosperity.

39. Even now there is some of the former shifting cultivation in very remote parts; squatters clear a piece of jungle and extract a crop which they seldom pay for, and as puttas are made out in their names, they appear as the chief revenue defaulters in the district. But after all such occupation is small.

40. *Conclusion.*—I trust I have now shown that the increased land for which rent is paid to Government is not all reclamation from the forest—even some land of this kind as still kept uncleared by its proprietors

(2.)—that the paying full assessment for grass lands does not involve the breaking up of such grass, such as it is, but only proves the increased capability of the people to pay for such lands.

(3.)—that the politic reduction of assessment on well lands has been a factor in the lesser average assessment rate.

(4.)—that an increased investment in land improvement has, without adding to the revenue, followed this reduction which is of the nature of an insurance against famine.

(5.)—that the cattle breeding and grazing grounds of the district have not been disturbed.

(6.)—that the increase of ploughing cattle is doubtless commensurate with the increase of land actually cultivated, and population.

41. A final remark I shall add. It is not usual among any class of men to admit increased prosperity; when a revision of assessment is made, a struggle follows to obtain a reduction. It is customary to refer to former times as better than the present, but my experience of India is not in accordance with such gloomy retrospect.

In their order reviewing Mr. Robertson's report on the Coimbatore District, the Government called on the Collector to report fully on the pasturage of his district. Mr. Wedderburn had already submitted some remarks on the subject, but in forwarding them to Government with their Proceedings, dated 21st December 1877, No. 5,318, the Board directed him to submit any further remarks he had to offer. Mr. Wedderburn's letter above recorded is his reply to this reference, and will now be submitted to Government with the remark that the Board attach great value to it as showing that the gloomy inferences not unnaturally drawn by Mr. Robertson from the facts observed by him are not really deducible when matters are viewed by the light of local knowledge and experience.

(Signed) J. STURROCK,
Acting Sub-Secretary.

THE GIANT BAMBOO OF INDIA AND CHINA.

(BAMBUSA INDICA GIGANTEA.)

By Mons. G. Delchevalerie, Member of the Institute of Egypt.

[Translated from the French by Lewis A. Bernays, Vice-President of the Queensland Acclimatisation Society.]

AN arborescent plant, the stems of which are like gigantic reeds and of colossal dimensions, 19 inches and more in circumference at the base, and attaining 70 feet in height; the knots, especially those of the smaller and upper part, produce numerous branches furnished with large, long, smooth leaves, narrowing below to a short leaf stalk; a sheath, 20 inches broad, covering the knots of the growing stems in the form of a shovel protecting the eyes, and falling to the ground as soon as these latter are perfectly formed and the stem attains its full development. This species, the most vigorous of those known to us, was introduced some years ago into the gardens of his Highness the Khedive, at Ghézireh, where we have been able to propagate it, and into two or three other gardens of Egypt. We have not yet had an opportunity of seeing it flower, although the first clumps planted at Ghézireh are very strong, counting more than 25 culms, each of them some 70 feet high, a little bent at the extremity, and thick as the trunks of trees. This species was admired by his Majesty Dom Pedro II, Emperor of Brazil, on the occasion of his visit to the Garden of Ghézireh last autumn, and his Majesty requested permission from his Highness the Khedive to take some specimens of this beautiful species back to Brazil. The Baron de Bom Retiro, Senator of the Empire of Brazil, who accompanied the Emperor on his travels in Egypt, told us that he cultivated, on the borders of his properties in Brazil, large umbrageous bamboos, under which the animals retired for shelter and repose during the heat of summer. Bamboos are useful plants, and highly appreciated in warm countries. The giant bamboo, originally from India and China, is one of the most useful species to the inhabitants of the countries where it is cultivated. They use its fine large poles for the uprights of their kiosks their huts, and their houses. By cutting the stems immediately below each knot, the portions thus cut, which are hollow, can be used as cups for holding liquids, as boxes, flower pots, &c. In China especially, and in India, they convert them into tobacco jars and boxes, carved or japanned, of considerable value, and forming an important article of trade. They also use its stout stems for making bridges, ladders, boat masts, water conduits, carts, wheel-barrows, various articles of furniture, and palanquins; and lastly, its wood is used in the arts, in a host of industries, and for agricultural purposes.

The giant bamboo of India grows with such rapidity that as the gardeners say, "You can see the stems grow." This rapidity of growth is such that their elongation is distinctly observable within the course of one day, and we have seen at Ghézireh bamboo culms grow 10 inches in a single night. During summer some roots which had started from the ground, reached in a very few days their natural height, which is 65 feet in Egypt, but which exceeds 80 feet in India and China. In the latter country condemned prisoners are subjected to the atrocious punishment of impalement by means of the bamboo. The sufferer is bound and placed upon the ground above a new sucker, which commences to grow and as it grows, tears the entrails out of the wretch, who thus dies in frightful agony. Some clumps of bamboo planted near a wall in Egypt would have overthrown it had we not applied remedial measures In order to afford an idea of the encroachments of this bamboo in Egypt and above all in Cochin China, at the period of growth, a time at which the suckers would lift any superincumbent obstacle, we will narrate an anecdote which happened to the late Compte de Montjoy, formerly Consul-General of France in China, an eminent amateur in horticulture and agriculture, to whom Europe is indebted for the introduction of a host of valuable plants from this country.

We will let Mons. de Montjoy tell in his own words what befel him:—"When I resided at Shanghai I had erected at the head of my garden a summer-house, very substantially constructed of wood and stone. A mission in the north necessitated absence with my family for two or three months, after our return one of my daughters exclaimed: 'Father, who has demolished our pavilion?' We approached to unravel the mystery, and this was what we saw. In place of the pretty building, which was only a heap of ruins, enormous stems of bamboo had formed a veritable forest, throughout which lay upon the ground the beams and stones. A feeble plant had, in a few weeks, accomplished the work of an earthquake."

The Chinese use the wood of the giant bamboos, which they plant on the banks of their rivers and canals. In Egypt we shall also be able to cultivate these gigantic reeds on the banks of the branches of the Nile, and it is proposed to make the experiment on the bank of the canals of Central Egypt and of Fayoum, in the vast domains of his Highness the Khedive, where the water level is nearly alike all through the year. This bamboo should be planted a good 3 feet above the level of the water, on the slope of the banks, and the water will find its way to the banks, by capillary attraction; By planting in this fashion the necessity of watering these tree-reeds is obviated, and, moreover, if occasionally a few leaves and young culms are eaten, or stems are taken away, vegetation will not thereby be arrested, and the plant will grow again from the root. Plants of this kind which reproduce themselves from the root are much more suitable for planting on streams than deciduous trees, such as the mulberry, the poplar, the robinia, the willow, &c., the leaf-clothed stems of which are greedily eaten by stock, and their wood used for burning and other purposes. Such trees, when once their stem is cut, are destroyed, while the bamboo, which reproduces itself from the root, soon sends up new stems. Next to the bamboo, thorny trees are best suited for planting on streams, the banks of which are used nearly throughout Egypt as roads for camels, horses, asses, buffaloes, goats, &c., nearly all of which like to browse on the foliage of young trees; but these animals necessarily respect the armed buds of the thorny acacias, and the gum-tree of the Nile (*Acacia Nilotica*) is one of the forest species best adapted for planting on streams. Its timber is in much request as fire-wood and for building timber, for which purposes it is scarce in the country.

The giant bamboo likes humid soils, but generally dreads prolonged floods; and it is for this reason that it is preferable to plant it a little above the water level. It dislikes too dry situations, and would not succeed on streams, the banks of which are elevated, and the bottom of which is dry during a considerable part of summer, as is the case in a part of Lower Egypt.

The giant bamboo of India is multiplied by division of the roots by detaching the suckers a little before the period when they begin to grow, and when they are perfectly formed. Each of these suckers is planted permanently, or if planted in a nursery they are placed about 6 feet apart. If, however, they are planted where they are to remain on the banks of streams, a distance of 16 feet is left between them. This operation being performed at the commencement and during the heats of summer, now growth is not retarded.

This bamboo is also multiplied by cutting its great stems at the foot, removing the whole of the upper part and leaving only about 3 feet in length of the lower extremity, which thus makes an excellent cutting, which being planted, for the purpose of irrigation, at the side of a trench will emit roots and buds from latent eyes at the base. The middle portion of the stem can again be cut into pieces having at least two eyes, the lower one of which is planted in the ground; but this kind of cutting does not succeed as well as those made from the base of the stem.

Another species of bamboo is also to be found in the gardens of Egypt which we believe to be the *Bambusa arundinacea* of Wildenow. It presents the following characteristics:—The culms are shorter and less thick than those of the giant bamboo of India; they only attain in Egypt 40 feet in height, but 60 feet in India. They form larger clumps than the first-named and produce a larger number of culms, though not so tall or so thick. They only shoot straight for the first 15 or 20 feet, and then bend away to their full length; they are furnished with numerous slender flexible branches, generally bearing strong and slightly bent thorns at the knots or articulations. The leaves are smaller than those of the preceding species, rounded at the base oblong lanceolate, pointed and accuminate at the top, with a slightly downy sheath. Groups of oblong ears, at long intervals, comprising two to six flowers, one of which is hermaphrodite, while the others are m[illegible]. Originally from India and China, this species is already widely spread [illegible] the gardens of Egypt, and produces excellent poles suitable for agricultural and other industrial uses. They are multiplied in the same manner as the preceding species, and even with greater facility.

There is another species in China which we recommend equally to the cultivator. This species, which only attains about 20 feet in height, produces enormous clumps of cane a little thicker than the finger, and makes capital stakes for horticultural purposes. One plant, in the second or third year, will produce a hundred culms, forming altogether an enormous and very dense clump. This species is the *Bambusa edulis*, thus called because its young shoots are used as food in China. This is multiplied still more easily than the preceding species by division of the stock, by sucker, and by underground roots.

There is one more species of bamboo which would be suitable for cultivation in Egypt: this is the black bamboo (*Bambusa nigra*). This species, brought from China into Egypt by Admiral Cocier, hardly attains 10 f[illegible] in height; it is chiefly distinguished by its slender branching culms, of a fine black color, of which they make canes, which constitute an important article of commerce, and writing pens from the branching shoots of the culms, and which are employed in Egypt by the native scriveners.

There are many other species of bamboo still to be introduced into Egypt, and which will make excellent ornamental plants for gardens, most of them producing capital poles and stakes; such as Bambusa aurea, B. distorta, B. flexuosa, B. Fortuni foliis variegatis, B. glauca, B. gracilis, B. metake, B. mitis, B. guilioi, B. scriptoria, B. spinosa, B. stric[illegible] B. thouarsii, B. tortuosa, B. variegata, B. verticillata, B. violascens, B. viridiglaucescens.

TOBACCO CULTIVATION IN INDIA.

THE *Manila Comercio* of the 28th June says:—

"Senor Monfort, who embarked yesterday in the *Mariveles* for Singapore, is one of the tobacco controllers of these islands, and under a special contract with the Government of British India is going to that country to give instructions regarding tobacco plantations, and to arrange for the same. For some time the British Government has been desirous to establish that culture in India, and we are glad that it has chosen a Spanish *employé* to take this first and most important step, and who, from experience, possesses the necessary knowledge for the undertaking. What is necessary now is to show that we are not sleeping, and that Philippine tobacco, not only will not lose but will double if possible its preponderance in the consumers' markets. Skilful cultivation, the necessary preparations, which the tobacco requires for its manufacture, comeliness in the latter, and the removal of impediments to its export will double the yield of the auctions, and not a leaf from the Far East can then compete with it advantageously. Should India supply tobacco as good at least as that of the Philippines, our production will fall off, and this is what we must avoid by the legitimate means of fair competition. Should we be unable to bear it, doing away with the monopoly completely may be a means of [illegible]. It must be done in good time, for if it comes too late, there wi[illegible] a difficulty in repairing the damage. Hence the subject should not be lost sight of from its importance, although its probable consequences are scarcely perceptible now."

THE BLUE GUM TREE.

IN an interesting paper on the *Eucalyptus globulus* read before the Pharmaceutical Society some weeks ago, Professor Bentley tells us something about the essential oils that are obtained in large quantities by distillation of the leaves of this tree. These oils are now prepared on a large scale and form an important article of commerce between England and Australia. They are used for various purposes,—as a solvent for resins in the preparation of varnishes, and diluting the more delicate essential oils used in perfumery:—

A recent application of the oil of *Eucalyptus globulus* is also by Mr. Rimmel, who has introduced what he has termed an "Aromatic Ozonizer," and which he recommends as a *pleasant disinfectant*. It is in the form of a coarse powder, composed, I am informed, of pine-wood saw-dust, through which is diffused the oil of eucalyptus, and also the oils of lavender, rosemary, and thyme. I have tried it for some time in my library and elsewhere, and it certainly communicates an agreeable freshness and pleasant odour to the air of the rooms. It has also been elsewhere stated that an excellent disinfectant may be made by adding from one to four ounces of eucalyptus oil to a bushel of deal saw-dust.

From the quantity of oil contained in the leaves of *Eucalyptus globulus*, they yield when burned a very large proportion of gas; and it is stated that one of the towns in the gold regions of Australia was for a long time lighted by gas thus obtained. The oil thus derived is said to produce a very brilliant flame; and as much as 10,000 cubic feet have been obtained from a ton of leaves. But the expense of collecting these leaves in a country where labour is so costly, appears to have proved a barrier to its employment, except under altogether exceptional circumstances.

Baron von Mueller has also shown that the ashes of the wood of the species of eucalyptus contain a very large proportion of potash. Their richness in this respect may be estimated from the fact that while the produce from the ashes of the elm and maple, which are the trees most esteemed for this purpose in America, is estimated at about 10 per cent, the ashes of the eucalyptus yield as much as 21 per cent of potash.

The barks of various species of eucalyptus have also been applied to useful purposes. Thus, in the *first place*, they are extensively used for tanning and dyeing, and they owe their value in these respects to the presence of similar constituents to those contained in oak bark and other substances commonly employed for such purposes in this and other countries. *Secondly*, the barks of many species may be used in paper-making. Several specimens of packing and printing papers thus prepared are now exhibited, as also a specimen of writing paper from the bark of one species.

The *eucalyptus* has also some valuable medical properties. Alluding to these, Professor Bentley says:—

So many medical practitioners have testified to the febrifugal properties of the leaves that their value in the treatment of intermittent fever can scarcely be doubted. In Australia also, and in some other districts where the plant has been introduced, the leaves have long had a popular reputation in the treatment of fevers. Their antiperiodic properties are, however, far less manifest than those of cinchona barks, and some of the exaggerated statements that have been made in reference to the efficiency of the leaves appear to have arisen under the mistaken impression of their containing one or more of the alkaloids of cinchona barks. The bark is also said to possess similar properties in this respect to the leaves. Several preparations of both bark and leaves, such as the tincture, fluid extract, syrup, extract, lozenges, pills, and many others, are now exhibited; but the best form of administration is probably the alcoholic tincture. Eucalyptus leaves have been likewise used for their stimulant and antispasmodic properties. The tincture has been especially recommended in bronchitis; and in the form of cigarettes the leaves are now frequently smoked, and are reputed when thus used to be efficacious in asthma, whooping cough, bronchitis, and other affections.

The preparations of eucalyptus have also been used with success in other affections; and lately a new method of dressing wounds, by using eucalyptus leaves instead of lint has likewise been recommended. The leaves are simply laid on the wounds; and it is said that their balsamic nature not only cures, but also removes all the unpleasant odour.

It should be especially noticed that in making preparations of eucalyptus leaves, the narrow, somewhat sickle-shaped ones which are obtained from the full-grown tree, should alone be used, as it has been proved that these are more efficacious than the broader leaves which are derived from the young plant.

Another popular use to which this now celebrated plant has lately been applied is to suspend a branch over a restless sleeper, or to place some leaves under the pillow, when it is said to produce sleep.

SEXUAL CHANGES IN PLANTS.

THERE has been a discussion in the English scientific works as to whether plants can change their sex. It originated in a paper by Mr. Shirley Hibberd, in which he showed that some hollies that had in other times borne berries freely had one season flowers in which were no signs of pistils, and in which the stamens had become proportionately more vigorous. The matter is exciting more than ordinary attention, from the opinion of Mr. Darwin a year or so ago, when there were scarcely any hollyberries in England, that the failure of the trees to produce them was from the absence of insects to cross-fertilize the flowers. Mr. Darwin subsequently confessed himself mistaken on that point; but the fact that he should make a suggestion shows how deeply impressed is the idea in leading scientific minds of Europe that "sixa" in plants is the analogue of sex in animals, and hence, the difficulty so many find in accepting Mr. Hibberd's experience in regard to "change of sex." In animals the whole individual partakes of the chracteristics of its seperate sex; but plant or tree is much nearer the idea of a community than of an individual, and the different sexes can be manifested at any point. Indeed, an American, says the New York *Independent*, needs no argument on the possibilities of the case, as the nearest corn-field will prove the fact, for it is of the commonest experience to find grains of corn in the tassel or male flowers, and male flowers in the ear, in the places where there should have been female flowers, of course. There is no change of sex in the sense that we should speak of such an event in the animal kingdom; but one form has appeared in the place where the other ought to have been. It is no change of sex in an individual but a change of places in the members of the same family. The discussion is, however, very interesting, as showing how different are the tendencies of science in different countries. With different surroundings, there seems to be even different sciences for different peoples, as there are different languages.

MAURITIUS.

(FROM A CORRESPONDENT.)

JUNE 27.

AS may be imagined from the large proportion of our population coming from your presidency, matters connected with Bengal, and indeed with all parts of India, are always subjects of interest here. It has occurred to me that your readers might not be indisposed to hear occasionally items of news from this colony, so I send you a short *résumé* of late events. The Mauritius planters are now passing through the idle time of the year when no produce is being made; and, in fact, there is next to nothing to do on the sugar estates In less than a month, however, the sugar of the next crop will begin to arrive in the market; and for about four or five months after that, all the plantations will present a scene of uninterrupted activity till the end of the season. Our colony has been prosperous for the last two years; and there is now very little doubt that another good season is in store for the planters, which simply means that Mauritius will do well for another year.

On the 9th April last, a deputation, consisting of the most influential merchants, &c., connected with our island, resident in London, waited on the Secretary of State to present a memorial remonstrating against the provisions of the Labor Law, which is to be applied in the case of employers of East Indian immigrants, by whom all the sugar-plantations in the colony are cultivated. The above law is in accordance with a recommendation of a Royal Commission sent here to enquire into the treatment of Indian coolies.

The annual report of the Assistant Director of Botanical Gardens has lately been received, from which it appears that half-a-million of plants were propagated last year, including 40,000 coffee trees. A plantation of 107 varieties of sugar-cane has been established at the forest nursery; and experiments are being made as regards the cultivation of ginger, arrowroot, black pepper, tobacco and catchouc. Hopes are entertained that pepper cultivation will form a considerable agricultural industry here at some later time. The Assistant Director recommends the cultivation of catchouc at the neighbouring islands of Seychelles. It is not perhaps generally known that our Botanical Gardens at Pamplemousses are said to be the finest in this part of the world, with the sole exception of those of Sydney.

A number of very small plants of Liberian coffee, received here in a Wardian case, which were put up at auction a day or two ago, and for which members of the Society of Acclimatisation only were allowed to bid, realised an average of Rs. 15 each !! The Liberian coffee, it is considered, is likely to be cultivated here on our low lying lands.

With regard to business matters, I am able to report a fair demand for Indian produce, which is moreover fetching prices which I should imagine would be considered satisfactory. The following are our quotations for grain of different kinds :—

Moonghy rice, 1st quality .. .	$ 11 40				per bag.
Ditto, 2nd ditto	„ 10 53	to	$ 11 0		„
Chota Ballam	„ 10 80	„	„ 11 0		„
Raree	„ 10 20	„	„ 10 50		„
Kusla	Market bare.				
Chittagong	$ 10 80	to	$ 10 60		per bag.
Calcutta Gram	„ 9 80	„	„ 10 0		„
Khassary Dholl	„ 10 80	„	„ 11 0		„
Doodall Wheat	„ 9 60	„	„ 9 80		„
Indian Oat	„ 6 50	„	„ 6 60		p. 50 kilos.

A NEW OIL MANUFACTURING COMPANY.

IT is in contemplation to start a new Company in Madras under the auspices of some of our leading merchants, for the sole purpose of extracting oils from the nuts and oil-seeds so abundantly produced in Southern India. The plant and material of the defunct Napier Foundry being available on the spot, it is believed that the new Company will have most of their wants almost fully met. They will, however, have to send for some odds and ends from England, as also engage the services there of a competent engineer, and, if necessary, an assistant engineer as well, to work the machines. When the Company is fairly launched, there will be an opportunity afforded of testing the quality of the ground-nut, cocoanut, gingelly, castor, and linseed oils, as manufactured from the rude, primitive, native mills worked by bulls, and those manufactured by the imported European machinery. The refuse of the nuts and seeds after the extraction of the oils is to be applied as manure for plantations. It is an ascertained fact, that the refuse obtained from the native mills contains more nourishment for plants than that obtained from European machinery at Colombo and elsewhere. Consequently a very great and an incessant demand exists for a certain preparation from the refuse of the native mills, resembling cakes, commonly known among the natives and mercantile community as *poonac*. The reason for this preference is owing to the poonac retaining a good quantity of oil from insufficient pressure, whereas the refuse obtained from the process of crushing the nuts and seed by the European method perhaps does not possess much or an equal quantity of nourishing matter in it for the plants. The oils obtained from the native mills, when unadulterated, have also been pronounced to be much dearer, for the same reasons, than those manufactured by the European method. The new Company will, therefore, have to consider all these matters in their several bearings, and as it will be composed of gentlemen perfectly conversant with the extent of local competition, and local requirements, we have no doubt they will steer clear of all shoals and rocks, and make the concern a boon to the public and a profitable one to the shareholders. From what could be learnt from those who have had a practical experience in this part of India, the new Company will have an ample field for its usefulness, and be the means, to some extent at least, of developing the country's resources. We wish the concern every success.—*Madras Times.*

THE ASCENT OF SAP IN TREES.

THE question as to what forces cause water to rise to such a remarkable height (frequently) in trees has had very various answers given to it. But these have mostly failed to account adequately for the phenomenon.

Capillary action is perhaps the oldest cause adduced. The view was long popular that water rose in trees like oil in a wick, the connected vessels of the wood forming capillary tubes. This view lost force when it was known that the wood of the conifers was without vessels; and it did not explain the weakening or stoppage of the rise of sap produced by amputation of the roots, nor the presence of air in the columns of sap.

Shortly after Dutrochet's thorough study of diffusion, this phenomenon was called in to account for the rise of sap. One grave objection to such a theory is the rapidity of the ascent of sap (it has been carefully measured) as compared with the slowness of diffusion, which depends simply on molecular motion; another is the inevitable consumption of the osmotic force of tension. So that other problematical forces had to be called in.

When Jamin found that the imbibtion of water through fine porous substances (*e.g.* blocks of gypsum) took place with great force, and that the air could thus be compressed to several atmospheres, an effect of this nature was affirmed to occur in living plants, the cell membrane being considered a porous substance. But in fact the natural saturated cell membrane has no air-filled pores, but only pores already filled with water, and even the hollow spaces, bounded by the cell membrane, are partly filled with water; besides, the fact that a branch, immediately after being cut off, loses in great measure the power of raising water, is against this theory.

A few years ago yet another theory was started, based on M. Quincke's discovery of the tendency of liquid films to expand rapidly upon wetable surfaces. The only advantage of this lay in accounting for the rapidity of the rise of sap; otherwise it was open to all the objections of the Jamin theory.

A theory has lately been propounded, and thoroughly worked out by M. Joseph Böhm, which is characterised by good consistency, and offers perhaps a more satisfactory explanation of the phenomenon than any that have been referred to. It is based, like the osmotic theory, on the cellular structure of all sap-conducting plants, and it attributes an important *rôle* to the *elasticity of the cells.* "When the surface-cells of a plant," says M. Böhm, "have lost a portion of their water through evaporation, they are somewhat compressed by the air-pressure. Like elastic bladders, however, they tend to take their original form. This, of course, is only possible by drawing in either air or water from without. Since, however, moist membranes are little penetrable by air, the cells draw from cells further in a portion of their liquid contents. These again borrow from their neighbours further down, which contain more water, and so on, either to the extreme root-cells or to those parts of the stem which are supplied with water from below through root-pressure."

To illustrate the action M. Böhm constructed an artificial cell-chain. A funnel closed by a bladder represented the evaporating leaf; to it were connected below several glass tubes about two ctm. wide, closed at one end with a bladder, and joined together in series by means of thick-walled catchouc-tubing. In consequence of the evaporation, the membrane which closes the funnel-mouth is bent inwards, and when it has reached a certain tension water is sucked into the funnel out of the next lower cell, which covers its loss in like manner. Manometers, connected with certain cells of the apparatus, indicate the amount of suction at different heights. To avoid fouling of the membranes carbolic acid was mixed with the distilled water in the cells. Since bladder membranes, with a not very great height of liquid column over them, admit passage of water by filtration, these artificial cell-chains (it is pointed out) must act much more imperfectly than the sap-conducting cells placed over one another in living plants, which cells, by reason of their narrow aperture, retain their liquid column by capillary attraction.

It is shown that this theory is in harmony with sundry phenomena which are contradictory of the imbibition theory.—*Der Naturforscher.*

INDIAN FIBRES.

THE substitution of Indian fibres for the substances now used in England, in the manufacture of paper having recently attracted the attention of the Secretary of State for India, the local Governments and Administrations were addressed on the subject in view to the collection of information on this important matter.

That many of the fibres grown in this country could successfully compete with the substances now in use in the manufacture of English paper, there cannot be the shadow of a doubt, and it would, therefore, prove of interest to know what has been done in regard to the matter of collecting information concerning the indigenous plants of this Empire most useful for paper-making. The usual G. O., no doubt, was written referring to the despatch of the Secretary of State to the Conservator of Forests; and this officer, in his turn, perhaps, indited the necessary "official memorandum" calling on his deputies and other subordinates "to supply the required information." With this, it is feared, the matter has been lost sight of in official circles, at least, for the present.

It may, perhaps, be in the recollection of many of your readers that, some years ago, Dr. Bidie, Superintendent of the Government Central Museum, delivered an interesting and instructive lecture on "Paper and the Natural History of Indian Paper-making materials," at the Museum, and in the course of his lecture he said, "I take credit to myself for having there recommended a system with reference to cotton, which has since been adopted by some of our leading mercantile houses. The recommendation was in effect to send agents into the cotton districts to buy the produce locally, and show the ryots that we were really in earnest, and wanted cotton." And speaking of this, Dr. Bidie believed "that the same course must be adopted as regards fibre for paper-making, if India is ever to send to the European markets the enormous amount of such material she is capable of producing. It is no use Collectors taking up desultory experiments in such matters, or Government reading the hard-headed ryots homilies on the subject in the District *Gazettes*. Such measures are always looked upon with suspicion by the cultivator as preludes to some new tax or something of that kind; but if a mercantile agent takes the field with a bag of rupees and says, 'I'll give you so much per maund for this fibre and so much for that other,' and seals the offer with an advance, then the ryot opens his eyes and proceeds to business."

This is just what ought to be done, and if it is seriously proposed to introduce into European markets Indian fibres for the manufacture of paper, a better plan could not, possibly be thought of; however much it is to be regretted that it has not been tried years ago. Individual collections of fibres have, from time to time, been exhibited. The Museum itself can shew a fair collection, and at the Agricultural Show in 1874, an overseer of the Madras Forest Department exhibited a very fine collection made by him in the Salem district and was awarded the first prize for fibres, *viz* rupees thirty.

To render the undertaking sufficiently remunerative, annual and biennial plants only should, it is remarked, be largely cultivated. Trees and shrubs take too long a time to mature to be productive; whereas, annuals and biennials could be profitably cultivated for their fibre. If the matter of the fibrous products of India were taken up in earnest by our mercantile houses—European or Native—there is not the slightest doubt that these products could be sold in the English markets so as to realise prices that would be fairly remunerative both to the grower as well as the exporter; and it is much to be regretted that European enterprise has not yet made a move in this direction. There is, perhaps, no place in the world richer in fibre-producing plants than India, and in no place can their cultivation be taken up more extensively and cheaply than in this Empire, and [illegible] has been done to start on a large scale this useful industry. This is not at all creditable to the enterprise and ingenuity of this age, and it is to be hoped that some of the leading European and Native merchants will be urged to see the importance of taking up in earnest this matter. *Correspondent of the Madras Times.*

MR. J. B. LAWES ON AGRICULTURAL EXPERIMENTS.

[From *The North British Agriculturist.*]

THE recent remarks of the Marquis of Huntly and Mr. Barclay, M.P., in connection with the Aberdeenshire Agricultural experiments have elicited the following from Mr. J. B. Lawes:—A little more than thirty years ago, I published my first, second, and third years' experiments upon the growth of turnips, which were recorded in the *Journal* of the Royal Agricultural Society for the year 1847. It is somewhat remarkable that some of the results then obtained, appear to confirm the conclusions drawn from the Aberdeen experiments, as will be seen by the following table:—

	Bulbs.		Leaves.	
	Tons.	Cwts.	Tons.	Cwts.
1. Calcined bone-dust 400lbs.) ...	10	4	8	13
2. The same dissolved	9	9	4	7
3. As 1 with 3 cwt. sulphate ammonia ...	10	1	6	13
4. As 2 with 3 cwt. sulphate ammonia ...	8	12	6	19

We have here, as in Aberdeenshire, equal results from soluble and insoluble phosphate. In Aberdeenshire the addition of ammonia, to the phosphate appears to have produced only water; here it has reduced the product of the bulb and increased that of the leaves. Although Mr. Barclay speaks more cautiously than the Marquis of Huntly, and does not think that a revolution in the manure trade and in the practice of farmers is justified without further investigation, still he considers that the results obtained in Aberdeenshire prove that in the controversy between Baron Liebig and myself on the subject of nitrogen, the Baron was right. The actual words used by Mr. Barclay, as I find them reported in your journal of the 8th, are as follo[illegible] "On the point at issue I think there is sufficient nitrogen for the plant either left in the soil, or procurable by the plant from the atmosphere, if the plant is provided with abundance of other food of a mineral character." Mr. Barclay is somewhat in error in regard to the question in dispute between Baron Liebig and myself. Neither of us doubted that if sufficient nitrogen existed in the soil the mineral manures would enable the plant to take it up; but Baron, Liebig went farther, and asserted that with a supply of mineral food and in the absence of nitrogen in the soil, plants could obtain their nitrogen from the atmosphere. The early experiments in Aberdeenshire and at Rothamsted would seem to justify the correctness of Baron Liebig's views; at all events they show that nitrogen supplied to the soil had comparatively little influence. What will happen in Aberdeenshire as the experiments progress can only be guessed at; at Rothamsted we are capable of showing direct results. With the exception of three years, when three successive crops of unmanured barley were taken, the field referred to has been continuously under roots since 1843. White turnips, sweeds, sugar beet, and mangolds have been grown. Part of the field has been kept always under mineral manures, part under the same minerals, with the addition of nitrogen in various forms, such as nitrate of soda, salts of ammonia, rape cake, dung. The last two crops have been mangolds, and I give the mean produce of the two crops under different treatment, in the following table:—

Mean average produce of mangolds per acre in the years 1876 and 1877.

	Bulbs.		Leaves.	
	Tons.	Cwts.	Tons.	Cwts.
1. Potash, soda, magnesia, superphosphate ...	7	12	1	9
2. As 1 with nitrate of soda	23	5	4	15
3. As 1 with salts of ammonia ...	18	5	3	5

There cannot be much difficulty in explaining the early results by these later ones. A good deal of accumulated nitrogen (condition) existed in the soil, which the superphosphate enabled the plant to gather up. When this is exhausted, the plant, with an unlimited amount of minerals at its disposal, uses up the nitrogen liberated each year by the decomposition of the soil; but if a larger crop than results from this is required, it can only be obtained by the supply of nitrogen in manures. The analysis of these mangolds show that those grown with the nitrate and ammonia are superior as food and as manure to those grown by the minerals alone; but as they are not quite ready for publication, I give the results of three years' average with sugar beet.

Average of three years, 1871, 1872, 1873.

	Bulb per Acre.	
	Tons.	Cwts.
Mineral manures only	5	18
With nitrate soda	19	2
With salts ammonia...	14	10

	Sugar in juice.	Nitrogen in dry Bulb.
	Per cent.	Per cent.
Minerals only	14·45	0·54
With nitrate soda	12·12	1·2
With salts ammonia	13·35	0·87

Although the percentage of sugar in the roots grown by the minerals only is higher than in those grown by the minerals with the addition of nitrogen, still, when we come to the acreage amount of sugar, we see how enormously it is increased by means of supplied nitrogen. In the acre grown by nitrate and minerals there is more than 2 tons of sugar. It will also be observed how much higher is the nitrogen in the roots manured with nitrate and ammonia, being in one case more than double. In feeding the mineral crops, not more than 14 or 15 lbs. of ammonia would be returned to the land, while in feeding the nitrate roots, between 80 and 90 lbs. would be returned. Thus nitrogen added to minerals largely increased the amount of food, as well as the value of the manure in the crop. This leaves but little doubt with regard to the relative value of bones and bone superphosphate as compared with manures of purely mineral origin; and I quite agree with the remarks of a writer in your paper of the 16th, who says it will take several years of experimenting to convince many Scotch farmers that mineral phosphates are as good as those of animal origin. No amount of experiments would convince me that such was the case. I am also disposed to agree with the writer in thinking that, if the object of these experiments were mainly commercial, it would be better attained by an ordinary rotation of crops. It is quite true, that in order to ascertain the properties of one crop as compared with another, it is essential to grow them on the same soil continuously; still the results obtained by such a process must be accepted with great caution.

Since 1848 we have had land under careful experiments, in which an ordinary four-course rotation has been carried on, and the results have been a very necessary check upon those obtained in the other fields.

The relative value to agriculturists of finely-ground mineral phosphates compared with the same phosphates dissolved by acid, can never be properly estimated by the continuous growth of roots. We have evidence that the gypsum, which is present in large quantities in soluble phosphates, has a very beneficial effect upon clover which forms part of a rotation, though the superphosphate had not been applied directly to the clover, but to the roots, two years previously. When soluble phosphate of lime is precipitated in the soil, it is in a finer state of division than can be effected by any mechanical operation; and as minuteness of division is one of the great objects to be attained, it would be reasonable to conclude that a dissolved phosphate would be more efficacious than one that was merely ground. Although, however, phosphates in every possible form have been under experiment here for about forty years, I have nothing conclusive to bring forward in regard to the great superiority of soluble over insoluble phosphates. This of itself may perhaps be taken as evidence that the results obtained in Aberdeenshire are not likely to revolutionize the operations of farmers. In arguing for the absolute necessity of a large amount of nitrogen in the soil in order to obtain full agricultural root crops, I by no means wish it to be assumed that I consider nitrogen to be an essential ingredient in a turnip manure. A mineral superphosphate may produce as large a crop of roots as a bone phosphate or Peruvian guano; but when it does so it is due to nitrogen having been accumulated in the soil by previous manuring; and the capital in the soil (condition) is more largely drawn upon than if nitrogen and phosphate were both used. In the absence of sufficient mineral food, or of the necessary climatic condition to obtain complete growth, nitrogen accumulates in growing crops. Again, two crops of roots may have precisely equal weights of [illegible] or even of dry produce, but they may have very different feeding and manuring properties.

Such facts as these show how very complicated a subject the experimenter has to deal with, and how cautious he ought to be in arriving at his conclusion. At some future time I will make some remarks upon the accumulation of nitrogen in plants.

J. B. LAWES.

Rothamstead, May 27, 1878.

THE ROYAL ENGLISH AGRICULTURAL SOCIETY'S FIELD EXPERIMENTS.

THE results of the first year's operations at the Woburn Experimental Farm in Bedfordshire, under the auspices of the Royal English Agricultural Society, have been published, and present some curious features. The conclusions already arrived at by those who conduct the Aberdeenshire Experimental Stations, are not quite in accordance with the observations and experience of many good, practical farmers. The first year's work on the English farm, however, has produced results, in some respects, of a more surprising character than those of the northern stations. Those good old farmers, who have discovered to their own satisfaction that in the growth of crops "there is nothing like *muck*," will shake their heads on learning that an application of 12 tons per acre of good farmyard dung had no beneficial effect on the wheat crop, and very little on barley.

To many agriculturists this statement must be astounding. The wheat crop of 1877 was sown in November of the preceding year. The dung and mineral manures were put in before the seed, and the salts of ammonia and nitrate of soda were top-dressed in spring. The unmanured portion yielded 22 bushels of grain, weighing 61¼ lbs. per bushel, and 20¾ cwt. per imperial acre. The plot which got 200 lbs. of ammonia salts alone in spring, gave a return of 84½ bushels of 60¼ lbs., and 37¼ cwt. of straw per imperial acre 275 lbs. of nitrate of soda produced nearly 3 bushels less grain, 3 oz per bushel lighter, and 3 cwt. less straw per acre than the ammonia salts did.

The section to which 200 lbs. sulphate of potass, 100 lbs. sulphate of soda, 100 lbs. sulphate of magnesia, and 3½ cwt. of superphosphate of lime were applied in autumn, gave no account whatever of the manure. The yield from the land thus treated was actually rather under that on the unmanured portion, both as regards quantity and weight of grain as well as weight of fodder. Another plot, however, similarly dosed in autumn, and then stimulated with 200 lbs. ammonia salts in spring, indicated a good return, but still left the mineral manures a blank, because the produce from the ammonia salts alone was rather higher for grain, though somewhat less for straw, than from both combined.

The maximum results were obtained from the application of 190 lbs. of ammonia salts in spring to a section which had been manured in autumn, with the above detailed allowance of mineral manures. On this plot there were 43¾ bushels, weighing 62 lbs. per bushel, and 45¾ cwt. of straw per acre. Nitrate of soda added to the mineral manures to the extent of 550 lbs. per acre, raised 89½ bushels, 61¼ lbs. and 42¾ cwt. of straw per acre. Two plots with farmyard manure alone, showed positively less return than the unmanured section. Thus both dung and mineral manures without nitrogen were last year completely thrown away on the Woburn experimental wheat crop. Again, whether applied alone or supplementary to mineral manures, a given amount of nitrogen was more effective in the form of ammonia salts than in the shape of nitrate of soda. This superiority in favour of ammonia salts, both as regards quantity and quality of grain and straw, was, it appears, quite apparent when the crop was on the root. From the one the corn was riper, and the straw of a better colour, from than the other.

The mineral manures having had no beneficial effect, indicates that the soil possessed in an available form all the mineral constituents required by the crop, and the great addition to the produce which followed the use of nitrogenous stuffs, points to the probability that the previous wheat crop had left the soil comparatively destitute of nitrogen. But the absence of any benefit from the nitrogen in the dung is more difficult to explain. It is conjectured that the excessively heavy rains of winter 1876-77 may have washed a good deal of the soluble nitrogen in the dung, through the porous soil, into the drains. But, as Drs. Lawes and Voelcker* say, "this supposition does not seem to afford a sufficient explanation of entire want of action."

The barley experimented on like the wheat succeeded a wheat crop. Precisely the same quantities and varieties of manures were used for barley as for wheat, with this difference, that the dung applied to the former was made in boxes in which experiments with various feeding-stuffs were conducted. The food and litter given to the animals in the boxes having been carefully weighed, the composition of the dung "could be estimated with greater accuracy." The highest yield in the barley plots, alike in respect of quantity and weight of grain and bulk of straw, was, as in the case of wheat, obtained from an application of 200 lbs. of sulphate of potass, 100 lbs. sulphate of soda, 100 lbs. sulphate of magnesia, 3½ cwt. superphosphate of lime, and 400 lbs. ammonia salts. Here again, however, the increase in bulk of both grain and straw, amounting to about 160 per cent., was wholly due to the salts of ammonia. Curiously the portion treated with mineral manures only produced rather less crop than was credited to the unmanured break. The latter produced 22¼ bushels of grain, 54¼ lbs. weight per bushel, and nearly 14 cwts. of straw per acre; whereas the maximum returns already referred to rates 52½ bushels of 56 lbs. per bushel, and 35½ cwts. of straw. Nitrate of soda proved in the barley crop about as much inferior to salts of ammonia as it did in the wheat. Five and a half tons of farmyard dung—estimated to contain 100 lbs. of ammonia, and made by the consumption of 376 lbs. cotton cake, 940 lbs maize meal, 12,857 lbs. mangolds, 3, 215lbs. wheat straw chaffed, and 3,164 lbs. barley straw as litter—applied per acre, grew 1⅔ bushels less grain and nearly 100 cwts. less straw than was reaped on the plot which got no manure. The grain on the former, however, was 1 lb. per bushel heavier. Double the above quantity of dung, made from exactly double the stuffs mentioned, increased the quantity both of grain and straw about 30 per cent., but the barley grown from the dung was ¼ lb. lighter per bushel.

The results in the wheat field are thus substantially confirmed by the returns of the barley crop. In reference to the rather remarkable fact, that where nitrogenous manures were used alone, the ammonia salts gave 8½ bushels more barley per acre than the nitrate of soda containing the same quantity of nitrogen, Drs. Lawes and Voelcker remark that "nitrate of soda is more subject to loss by damage than are ammonia salts; and the result may be partly due to more washing out in its case, but probably in a greater degree to the nitrate having been sown later than the ammonia salts, and possibly unfavourably later for the soil and season." The dung having been applied in the spring to the barley, was not of course exposed to the same risk of loss by damage as it was in the wheat field, yet the effect in the crop was in both instances almost *nil*.

One field of four acres has been set apart for a four years' rotation of crops, *viz.*, seeds, wheat, roots, barley. Last summer the grass, consisting of clover and ryegrass, was fed off by sheep, and the land is now under wheat. On one acre 728 lbs. of maize meal were consumed, on another acre a similar quantity of decorticated cotton cake were eaten, while the "third and fourth acres were separately eaten off without any purchased food." On one of these two acres artificial manure, furnishing nitrogen and other constituents equivalent to those calculated to be contained in the manure from 728 lbs. of cotton cake consumed on the grass, and on the other acre manures equal to the manure from the 728 lbs. of maize meal consumed, were applied to the wheat in spring. The results on the present wheat crop from these different treatments will be looked forward to with interest.

The sheep were on the grass from the 10th of May till the end of July, and from the end of August till the middle of October. Ten sheep were on each acre. Those consuming the cotton cake as well as the grass, showed an increased live-weight for fifteen weeks of 303 lbs; those getting maize meal in the same period advanced in live weight 275 lbs. One of the lots, fed on grass only, added 214 lbs. to their aggregate live-weight in fourteen and a half weeks; and the other lot in thirteen and a half weeks made 209½ lbs., showing an increase, supposed to be due to the cotton cake, of 91¼lbs., and to the maize meal of 63¼ lbs. Both with the oxen in the boxes and with the sheep in the field the conductors report that a "given weight of cotton cake has yielded more increase than a given weight of maize meal. The small number of oxen and also of sheep experimented on, however, do not afford quite conclusive evidence on the point, and it is proposed to carry out similar experiments with a much larger number of animals this year.

Other four acres are to be cropped in the following order:—Roots, barley seeds, wheat, mangolds, were accordingly grown on this field last year. One acre was manured with dung made from 3,230 lbs. of straw as litter, 5,000 lbs. of mangolds, 1,250 lbs. wheat straw as chaff, and 1,000 lbs. cotton cake. The second acre differed from the 1st only in having 1,000 lbs. maize meal substituted for the cotton cake. The third and fourth acres received the same quantities of dung as the first and second, *minus* the cotton cake and maize meal elements. But one of the acres "received artificial manure, supplying two-thirds as much nitrogen and as much of the other constituents as were estimated to be contained in the manure from the 1,000 lbs. of cotton cake; and the other received artificial manure, supplying the whole of the nitrogen and the other constituents estimated to be contained in the manure from the 1000 lbs maize meal." By far the biggest return was on the third acre, which got two-thirds as much nitrogen and the other constituents of the manure from 1000 lbs. cotton cake, *viz.*—248 lbs nitrate of soda, 100 lbs. bone-ash superphosphate, 62½ lbs. sulphate of potass, and 65 lbs. sulphate of magnesia. This, together with from three to four tons of dung per acre, produced 7 tons 4¾ cwts. of roots, with three tons 8¼ cwts. of leaves per imperial acre. Next to this acre stood the first one, which had the benefit of the cotton cake manure, and yielded 3 tons 17 cwts. of roots and 2 tons 15 cwts. of leaves. The acre to which the maize meal manure had been applied, showed comparatively the smallest return. The crop was a light one, but the season was unfavourable; the quantity of dung allowed was not only about one-sixth of what is usually applied to mangolds, but it was deemed imprudent to dispense a heavy dose, since every crop during the rotation will be manured for experimental purposes.

PEPPER CULTIVATION.

THE PEPPER SHOULD BE PLANTED IN A LOW FIRM GROUND.

IN the beginning of the month of June, when the rain falls incessantly, at the foot of a jack, mango, cajou, marein, or any other tree, whose bark is rough or prickly, dig a hole one foot deep, the breadth and length six inches; into this hole put a cutting from the extremity of one of the branches of a pepper vine, then fill it up with earth, taking care no water is therein, and that none may remain after planting. In the month of July roots will extend themselves in the ground, and the sprouts will appear on the surface, when they are to be tied to a tree, and a circular bank of earth thrown up round them, that they may enjoy the moisture of the water, which remains on the ground, and sheltered from the heat that prevails from the month of July to October, when the rains cease; cover the root of the vines with fresh leaves, it matters not from what tree, so that they have the quality of cooling. If the ground is too dry, water the same, morning and evening; but if it is entirely cool, twice in eight days is sufficient. Then plant five or six sprigs at the foot of the same tree, taking particular care they in no wise touch each other. Ten days after the rains set in, remove the leaves that cover the root of the vine, pull up the grass that may have grown near them, and demolish the circular bank of earth made to contain the water, that none may remain at the foot of the tree. In the month of August repeat the same. The vines are to be cherished in this manner for three years. It must be observed, that the foot of the vines should be covered every year, in the manner before mentioned. If the vine is once smothered by the heat, it will begin to languish and produce no fruit; so it is necessary to follow the above instructions. The leaves ought likewise to be removed in the mouth of June, to prevent the white ants from reaching the root of the vine.

THE MANNER OF PLANTING IN THE MONTH OF FEBRUARY, WHEN THE GROUND IS LOW AND FIRM.

Having made a hole ten inches from the tree, the depth thereof being fifteen inches, the length and breadth twelve inches each, take seven branches from the extremity of the vine, cut them thirty inches long, and put them into the hole, then fill it three quarters with earth, and the remainder with fresh leaves, observing to put water thereon, morning and evening, till the commencement of the rains when fill the whole with earth, and throw up the bank as before directed. The time for planting these vines, in the rainy season, is in the month of June, and in the month of February in the dry season; if they are planted at any other time they will not bear fruit. Trees planted for the support of pepper vines, ought to be fifteen or sixteen feet asunder; if closer, the branches will shade the vines from the sun, and they ought to receive a moderate amount of warmth.

MANNER OF PLANTING IN HIGHER SITUATIONS AND FIRM GROUND.

Make a square hole fifteen inches, the same distance from the tree, take ten branches from the extremity of the vine, of seven inches length each put them into the hole at a certain distance, filling it with earth, and treating them as before directed. Two years after they are planted, it is necessary to throw up a square bank of earth round every five plants, that the rain-water may soak in, and nourish the roots; if this is omitted during the rains, the vine will not subsist during the dry season, on account of the heat. This square is to be repaired every three years, by which means the vine will live a long time, and produce plenty of pepper, it ought to be done during the rains, in the month of July.

MANNER OF PLANTING IN VERY HIGH GROUND.

Make a square hole 2½ feet deep, at the same distance from the tree, take twelve slips from the extremity of one of the vines, two feet nine inches long, put them into a hole at a certain distance, and cover them as before directed, throwing up the square bank It is necessary to plant these vines at the time before mentioned. The reason for making the hole deeper, is on account of the heat which prevails on high places Vines planted in a stony soil will not produce any fruit, because the roots cannot extend themselves with facility.

A sandy soil is equally prejudicial to them because it is naturally hot: and the heat of the sun penetrates with more facility than in any other ground.

You may plant vines in a place where fresh water communicates itself, in the same manner as in ground entirely low and firm, but I doubt very much if they will produce pepper; if they yield any, I am certain the grapes will be of no great account, because of the continual moisture the plant will receive. I have already remarked, it is absolutely necessary that the vines enjoy an equal degree of heat and moisture, if you think of gathering a good crop.

MANNER OF PLANTING THE PEPPER GRAIN.

Take ripe pepper and put into water for three days, at the end of which take off the skin, and after you have mixed good red earth, with cow dung and water, put the pepper into it, exposing the same to the sun for three days, early in the morning and the evening; it is necessary this mixture be neither too thick nor too thin; after this, plant the same in an earthen pot, every grain at a certain distance, taking care to water them every day, with a water-pot, until the stalk has four leaves; then dig a hole at the foot of a tree, two feet deep and nine inches long and broad; take cow-dung and ashes of all sorts of firewood, put it into the hole and mix the same with the ground dug out of it, taking care to fill it in such a manner, that there only remains five inches of elevation. Fifteen days after plant four pepper vines in every hole, cover them with earth two inches deep; during the summer water them every day, morning and evening, and cover during the rains; likewise take care that no water remains at their feet, by covering them with earth; as soon as the rains are over, throw up a circular bank of earth round them to contain the water they are watered with. In this manner they must be nourished for three years; in the fourth year they will begin to give fruit These instructions are to be followed every year. These pepper plants are planted either in high or low ground, but it is necessary it be very firm.

MANNER OF PLANTING WHERE SALT WATER IS.

After having made a hole, thirteen inches square, at the foot of a tree, fill the same half up with good red earth without mixing it in the least with the salt water; than plant therein ten slips of those vines, at a certain distance, and cover the same with good red earth. When the rains are over, throw again red earth at their feet, and make a circular bank round them, to form a conservatory, for watering them every other day, taking particular care to cover the feet of the branches with fresh leaves. In the beginning of the rains, fill the conservatory and take away the leaves, observing to pull up the grass that sprouts at their feet, covering them with red earth, at the some time spreading same round about, they are to be nourished every year, as is pointed out at the beginning of these instructions.

THE GARDEN.

A CORRESPONDENT in the Kangra Valley wrote a few weeks ago :—"The evil which men and hailstorms do live after them. This is exemplified by the mangoes this season, of which a large percentage are bruised. Other fruit there are simply none, saving a few peaches of stony constitution; and the grenadilla, the fruit of the passion-flower. I do not know if it is generally known that this is one of the most perfect fruits in the tropics; for I have frequently met people who regarded the plant merely as an ornamental creeper. The fruit ripens about this time, and is not unlike a magnum bonum plum in color and shape; the outer skin being hard, and the inside composed of glutinous seeds with a fragrance and taste that is as peculiar as it is pleasant. The creeper grows most luxuriously, and yields plenty of fruit, which ripens off best in the sun; but is apt to rot when growing round a verandah and under the shade of the eave of the roof. The passion-flower I have alluded to, the classical name of which I do not know, is the one with large light green leaves and waxen flower, and I would recommend an experiment on the fruit to any one to whom this paragraph may be news."

BANGALORE FLOWER SHOW.

THE show appears to have been a great success this year. There was a fine show of roses and the foliage plants are said to have been the best that Bangalore has ever seen. The ferns were fine, and of various kinds, and their arrangement was very good. The fruit show was a great improvement on last year; the apples especially were very good, and so were the figs. The vegetables, however, were poor, and upon the whole not better than last year, if as good. The cut flowers were well got up, and we were surprised to find that two prizes were carried off by natives. Those who have had the charge of the show are to be congratulated on the success that they attained, and more credit is due to them on account of the many difficulties that they have had to contend with.

AGRI-HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Thursday, the 25th July, 1878.

W. H. COGSWELL, ESQ, *V.P., in the Chair.*

THE proceedings of the last meeting were read and confirmed.

Mr. George Takeda was elected a member.

The names of the following gentlemen were submited as desirous of joining the Society :—

Nawab Shumsheer Jung, Hydrabad,—proposed by Mr. J. E. Grimley, seconded by Baboo P. C. Mittra.

C. R. O'Donoghue, Esq., Puttabong Tea Estate, Darjeeling,—proposed by the Secretary, seconded by Dr. Barry.

T. R. Stokoe, Esq., Barrister, Calcutta,—proposed by Mr. J. H. A Branson, seconded by Mr. Cogswell.

The Superintendent of the Nuddea Jail, —proposed by the Secretary seconded by Mr Robinson.

Rejoined—A. C. Pott, Esq., Calcutta; R. D. Stewart, Esq., Julpigoree, and Dr. J. W. Tylor, Agra.

CONTRIBUTIONS.

1. Report on the wheat cultivation and trade of the N.-W. Provinces —From the Director of Agriculture, N.-W. Provinces.
2. Report of Committee of Bengal Chamber of Commerce, November 1877 to April 1878:—From the Chamber.
3. Records of the Geological Survey of India, Vol. XI, Parts 1 and 2.
4. A collection of seeds of Australian trees and shrubs.—From Captain C. J. Wilkinson.
5. A plant of *Hippeastrum pardinuum.*—From Mr. J. Lynam.

Mr. Lynam also sends for inspection a plant of *Oncidium Lanceanum* in flower, which he has found to succeed well here—"it is as hardy as *O. luridum* and requires as much sun; it is not often seen in flower in England. I cannot say whether it has flowered here before or not; it is now a fortnight in bloom, and is declining; it was much larger and the colour much brighter than it is now when it opened first. It is admirably suited for Calcutta, as it stands both heat and sun. It was sent to England many years ago by Consul Lance from British Guiana."

GARDEN.

The Head Gardener's monthly report was read, of which the following are extracts :—

"The principal works carried on since the 1st instant have been rose layering, lichee, 'gotees,' lime, &c.; 'gotees' of various shrubs about the garden. The work would have progressed quicker had the early part of the month been more seasonable, but as the weather was rather dry, a considerable amount of the *mallees'* time was taken up with watering plants in pots; this also engaged the coolies for supplying water. Now that the weather has settled down to rain, the garden coolies are more fully engaged on their legitimate work of grass-cutting and clearing the garden. Owing to the rapid growth of grass, the garden became very rough-looking, therefore twelve additional coolies (as authorised) have been put on to give the garden a thorough cleaning; they will be retained for a month. The grass is cut by ordinary sickles which serve fairly when the grass is long, but when the next growth attains about six inches, it will require cutting again, which would be done more expeditiously and neatly by means of scythes. Several packets of mahogany seeds, which have been received from Dr. King, have been duly sown, and the first lot have germinated; one lot, sown 22nd June, has been potted off. Seven different kinds of 'maize' were sown and are growing nicely after the late showers. Cuttings of various desiderata have been put down in the sand beds. Cutting of the more valuable plants will be pushed forward as soon as some of the *mallees* shall have finished layering and in-arching, as their hands will then be free; some of the work being a little backward owing to the change of Head Gardeners. Forty kinds of chrysanthemums (which were bought from Mr. Head) were dead out of 100 kinds, before I took charge, and a few new crotons have succumbed since; they were in a very weak state. On the 1st July delivery orders came in rapidly, but are each cleared off as soon as possible. A detailed report about the mahogany seed will be sent in a short time, as soon as I see the result of the different methods of sowing which I am trying."

The Garden Committee's report was next read. The Committee suggest the employment of scythemen to cut the grass in place of the present mode of outside cutters, which is by no means satisfactory. The Committee have to report that the mode of conveying water from the entrance tank to the nurseries, by means of underground pipes, as suggested in a former report, was completed in April, and has been found to work satisfactorily.

Additional expenditure for engagement of three scythemen was granted.

MANURE FOR TEA GARDENS.

The Secretary submitted some valuable detailed particulars regarding the application of manures of sorts to tea plants, with which he had been favoured by a mercantile firm largely interested in the tea industry; whereupon it was *resolved* that applications be made to some other houses for any information they may be able to afford, and that the same be incorporated in a paper for publication in the Journal.

TOBACCO.

Read a letter from the Deputy Commissioner of Cooch Behar, sending samples of Cooch Behar tobacco cured by Mr. Paterson under the firing process, and asking for an opinion on their quality, and if the tobacco will make cigars, and if it will be fit for the pipe.

Mr. Eisenlohr, a member for the Tobacco Committee, is of opinion that the leaves are well cured, of good colour, and of strong and somewhat astringent flavour.

Messrs. Begg, Dunlop and Co. have obligingly furnished reports on this tobacco from their Superintendents at Ghazeepore and Poosah. The former writes as follows:—

"The sample of Cooch Behar tobacco seems to have been fairly well cured, but the colour is not very regular, some of it is altogether too dark; it is however fairly tough, and has enough life and gum in it. It would, I think, make very passable wrappers for low grade Cavendish, but is of course quite unsuitable for cigar-making.

"This tobacco has been raised from Rungpore seed, and the texture coarse and the stems large. Had the experiment been tried with American seed, it would have been more successful, I think."

And the latter observes:—

"I am sorry I cannot say much in its favour. It shows, however, to have been cured in a better climate than either Ghazeepore or Poosah. The sample you send is of the Hatican variety, and cured as this is, could only be used as fillers for low grade tobaccos, and would have to be mixed with other tobacco to give it flavour. In the English market it would bring about 2*d.* or 2½*d.* If cured differently it might make cigars like Burma cigars.",

APPLICATIONS FOR SEEDS.

Applications were read—

From the Assistant Secretary, Government of Bengal, for a quantity of Virginia tobacco seed for experimental cultivation in the Government Garden at Monghyr. (Complied with.)

From the Government of India, Department of Agriculture, for a quantity of New Orleans cotton seed for the Government of the N.-W. Provinces for experimental cultivation. (Complied with.)

From the Deputy Commissioner of Seonee, for seed of *Reana luxurians*, for experimental purposes in his district. (Complied with.)

From E. Buck, Esq., for seed of Guinea grass, Reana, flowering shrubs, for the Cawnpore Government Garden. (Complied with.)

Letters were submitted—

From H. E. Abbott, Esq., of Jaintpore Factory, Tirhoot, forwarding sample of cotton raised from the Bamia seed, supplied by the Society, in his late brother's garden. "There would have been more," writes Mr. Abbott, "but goats were allowed evidently to graze all over the place just after his death, and almost destroyed the plants. I have given a respectable *ryot* all the seed that escaped, and offered him a handsome bonus to bring me the produce, so next year I hope to send you reliable statistics. The sample sent is discolored [it is however of good quality in length and strength] from exposure and carelessness; but its immense superiority over native cotton needs no remark. I would gladly take a large quantity."

From Under Secretary, Government of India, Department of Agriculture, enclosing copy of a report from the Director of Agriculture, North-Western Provinces, on the experimental cultivation of *Reana luxurians* in those provinces. (Transferred for Journal.)

From the Director, Department of Agriculture, N.-W. Provinces, forwarding copy of a review by the Government, of the Annual Report of the Horticultural Garden at Lucknow for 1877-78.

From the same, forwarding particulars regarding the result of experimental cultivation in the Lucknow Garden of Bamia cotton. (Transferred for Journal.)

From the same, alluding to the expected arrival of a large quantity of American tobacco seed, and enquires if the Society would like to have some of the acclimatized stock in due course. (Offer thankfully accepted.)

From Colonel W. H. Lowther, Benares, alluding in the following extract, to the destructive effect on vegetation of the late unusually hot weather:—

"The last fortnight of June is the hotest period I can remember in India. The sun seems to have possessed some extra scorching power, as whole gardens of choice 'mango' and 'orange' trees can testify—dead to the very tap root! I am told at Lucknow and Ghazeepore they have suffered equally, and all gardeners attribute it to the same cause. My garden has suffered in rose trees and shrubs, and I have lost nearly every novelty raised from seed in pots and boxes, while strange to say *Ipomopsis* in the open borders has withstood: it is now flowering fairly as in the early hot months. It ought to be more generally grown, as it is a charming annual in various colours. Nothing could hurt the 'gaillardias'; they have been flowering during the worst time, and seemed to thrive in it! Two fine plants of *Romneya coulteri* in the open border are thriving, while all the promising specimens in pots have perished in the first shower of rain. I find here, as a general rule, that plants do far better in the open ground (well prepared soil of vegetable and animal manures) than in pots. Boxes, too, are far better than pots, as *they do not conduct heat*.

From W. H. D'Oyly, Esq., applying for certain information regarding flax culture in Bengal and Behar in former years. (Complied with.)

From E. Buck, Esq., inquiring if *Blighia sapida* has been acclimatized in Bengal. "A tree in the Government Garden at Cawnpore, imported some years ago by Mr. Halsey, has fruited for two or three years, and I have four young trees, of which I shall be glad to send you two if required. It will probably thrive better in Bengal than in this climate. Can you inform me if the fruit is edible, or whether the tree is in any way useful?"

The Secretary placed on the table some fruit of this tree ("akee") now ripening in the Society's Garden. It is acclimatized here, but is still a scarce tree, not seeming to be much in request. The fruit is edible; the aril is the edible part, it is said to possess a rather agreeable sub-acid, and it is sometimes eaten in a cooked state. It is a native of Guinea, but appears to be now common in South America and the West Indies. A small quantity of semi-solid fatty oil is obtainable from the seed by pressure.

REPORT UPON SAMPLE OF JALAP ROOT GROWN IN GOVERNMENT BOTANICAL GARDENS, OOTACAMUND.

(*Referred to in letter from the Government of Madras Public Department, No 47, dated 22nd November* 1877.)

SAMPLES of the Jalap root sent Home from Madras, as per letter under reference, have been submitted for valuation and opinion to two of the leading firms of London Drug Brokers (A and B) and also to a firm of Pharmaceutical Chemists of the highest reputation (C).

Brokers' Valuation A, founded upon careful examination and analysis states that while Vera Cruz tubers (the Jalap of commerce) yield from 12 to 18 per cent of Resin, the sample gave 14·857 per cent., a fair average, while from the Resin, 80 per cent. of Jalapine was obtained. The sample is valued at from 10s. to 12s. per lb. Appended to this valuation are the following remarks:—

"The percentage of Resin is a good average, the late Daniel Hanbury having estimated Vera Cruz Jalap to yield from 12 to 18 per cent., and that estimate is probably too high.

"In 1870 the same high authority referring to Jalap from Ootacamund spoke of a fine cluster of tubers weighing over 9 lbs., and statetd hat he had obtained from some tubers from the same source as much as 18 per cent. of Resin."

Brokers' Valuation B, evidently founded upon a merely superficial examination, is to the effect that the sample is not worth half the price of Mexican Jalap (9s. to 12s. per lb.) and does not contain any of the properties of the latter; and that in its present color and shape it would be almost impossible to sell it.

This opinion being so greatly at variance with that given in valuation A, a sample was submitted to a firm of Chemists.

Chemists' Valuation C.—"The sample contains 13·8 per cent. of Resin, not a large quantity as compared with the Jalap commercially known which contains from 12 to 18 per cent."

"The sample is good and sound, light in color, and as it would yield a good-looking powder, it might meet with purchasers.

Relying then upon Valuations A and C, as having been founded upon careful examination and analysis, the Ootacamund tubers may be estimated to contain from 14 to 15 per cent. of Resin, which according to Valuation A yields 80 per cent. of Jalapine, percentages sufficiently high to warrant an attempt being made to introduce the Ootacamund product inte the western markets.

Attention will, however, have to be given to the condition in which the tubers are prepared for shipment, respecting which the following remarks are appended to Valuation A—

"Care should be taken to thoroughly dry tubers before shipment, and it would be better to send them Home whole instead of in slices, as in the case of the sample. The Mexican tubers are generally packed for shipment in mat bags and thick gunny in parcels weighing from 1½ to 2 cwts."

And in Valuation C it is stated that Jalap dried and sliced like the sample is unknown in the drug markets, the tubers being either dried whole or, if large, cut into four parts.

(Signed) J. FORBES WATSON.

30th April 1878.

AGRI-HORTICULTURAL SOCIETY OF MADRAS.

At a Meeting of the Committee of the Agri-Horticultural Society of Madras, held at the Gardens on the 10th July, several contributions made to the Gardens, were acknowledged and a vote of thanks was passed to the donors. Read letter from A. Stormont, Esq., Khandesh Experimental Farm, Bhadgaon, dated 4th June 1878, thanking the Society for copies of Proceedings, forwarding 100 seeds of Bahmie cotton, and offering more from last year's crop if desired. Resolved, that Mr. Stormont be thanked for his letter and for the seeds, and informed that if it be hereafter found necessary the Society will thankfully avail itself of his kind offer of a further supply of the latter. Read letter from L. A. Bernays, Esq., Vice-President Queensland Acclimatisation Society, dated 17th April 1878, forwarding the munificent donations specified above, asking for palm seeds of all kinds, particularly Borassus flabelliformis (Palmyra) and orchids (to arrive in August or September), stating that "the drought is now a thing of the past—the rains have restored the whole of this district and farmers, gardeners, and graziers wear cheerful countenances once more—our gardens never looked in finer order," and begging us to make further demands on him. Resolved, that Mr. Bernays and the Queensland Acclimatisation Society be thanked specially, and that every effort be made to meet their requirements. Read letter from W. T. Thiselton Dyer, Esq., Assistant Director Royal Gardens, Kew, dated 15th May 1878, forwarding seeds of Pithecolobium saman, believed to be "the Rain tree of Moyobamba," and stating that this tree is found to be of great value in hot countries, grass growing under its shade, and its pods, produced in profusion being greedily eaten by cattle, which become very fat upon them. Read also letters from the same gentleman, dated 10th May and 4th June 1878, acknowledging packets of seeds and a Wardian case despatched in April last. Resolved, that these letters be recorded, and that a further attempt be made to send live plants of Oldenlandia to Kew, those sent having perished.

FORESTRY.

A CORRESPONDENT, writing of arboriculture and the wretched pittance of Rs. 500 doled out to each district for nurseries and planting, remarks, very reasonably, that it might be better to give one district the allowance of five districts for five years—a shorter period would be insufficient. With such a sum to spend, something might be accomplished beyond the erection of mud walls and the entertainment of a few itinerant *bheesties*

It was lately stated that the Government of Bombay had asked the Conservator of Forests to report upon those in the Bhore territory. We learn that it has been proposed that Government should take charge of all the forests in the Bhore territory, and after deducting the working expenses from the income realized by them, that the surplus revenue should be handed over to the Punt Suchev of Bhore.

The Scottish Arboricultural Society has lately found out that the oak and the sycamore are of little value for timber until they are 100 years old; that the elm, which retains its hardness and cohesive power longer than the oak when exposed to water for any length of period as in the piles of bridges, is useless till 80 or 100 years old; the poplar till 50 years old, and the ash and the birch till 40 years old. The birch of course is valuable long before that period for the school-room, and also for the manufacture of umbrellas; but for ordinary timber purposes the birch attains its prime with the ash, after some 40 years' growth. It would be interesting to follow out this inquiry with regard to the sal, toon, deodar, sissoo, and other trees of India used for building, to know when they reach their prime, and what steps are being taken for periodically re-stocking the Forests from which the largest supplies are drawn for the requirements of the D. P. W. and the various Gun Carriage Agencies of the three Presidencies.

Protection of Wood from worms—Borers.—If bamboos are cut at nights, when the moon is shining, they cannot be defended from wood borers called *goonah*. Even when every precaution is taken, and the bamboo grows old, to some extent this *teredo* will infest them. Bamboos to be used for any building or trellis work should be bought new and placed in a pond for a month or two covered with water. Then when taken out should be conveyed to a distance, as a very unpleasant odour is thrown out by them. Painting them certainly would answer; but when cut to the proper sizes, they should have a lick of coal tar when hot, which [illegible] wood or bamboo. The smell of tar soon goes away. To prevent insects getting into pianos, the best way is to have a cover for the bottom portion and fill up the holes of the pedal bars. This is seldom done, and if the smell would not be objected to in a drawing-room (for a gentleman) to paint the inside with kerosine, and then leave a saucer filled with *coal tar* inside the piano. The odour is imbibed by the wood, and is very noxious to insects; then cover the piano up, and the scent is *kept inside* very much. If pig-stickers want good bamboo spear shafts, they should be tough—from the hills—cut on a dark night, kept in water for a month, taken out and dried, when yellow smeared with mustard oil, washed also with milk when dry, and the heels of the bamboos kept in a pot of buffaloe milk, and the bamboo will absorb it all quickly. Several at once should come under this treatment every day and a few rupees spared. When nine months old, their size will shrink in diameter calibre; and all they require is a rub of mustard oil every two or three days.—Bretwalda in the *Pioneer*.

BLASTING TREE STUMPS.

"A FORESTER" writes in answer to "Paddle" that he has blasted many roots by the old method of boring a hole in the stump with an inch wimble, the hole reaching as near to the centre of the root as possible, filling the hole with coarse blasting powder to within two inches of the top, and filling to the surface with moist clay hammered very firmly. The powder is also pressed very firmly with a hard wooden rammer. Previous to placing in the clay, one end of a fuse is inserted in the powder, the other passing through the clay for the purpose of being lighted. If shelter is near, the fuse need only be short, but if the roots are in the open the fuse must be longer, so that when lighted it does not ignite the powder before the operator has retreated to safe distance from the point of explosion. A little experiment as to the time a given length of fuse will burn, will suggest the length required for any particular site or operation. Our correspondent states that he has blasted roots very successfully by that plan, and has never met with or seen an accident occur to those engaged in the work.—*Journal of Horticulture.*

A CENTRAL FOREST SCHOOL.

Under present arrangements, which have been in force since 1866 the training of superior officers for the service of the Government of India in the Forest Department is carried on at Nancy in France, and neither for these, nor for the inferior officers, is there any systematic training provided in India, except such experience as is gained in the performance of their duties.

It is evident, remark the Government in a Resolution of the 1st July that this system has its disadvantages. "India is dependent on Europe for the training of its officers, while it possesses ample means of providing such training in its own forests, if a properly organized system were set on foot. The Natives of India, whom it is extremely desirable to employ in all grades of the Forest Department, cannot, without a prolonged visit to Europe, obtain that systematic training which is necessary to render them competent to fill the superior offices, and for them, as well as for others the establishment of a school in India for the scientific teaching of the principles and practice of forestry has long been looked upon by the Government of India as an object to be effected. This question engaged the attention of the Government of India in 1869, when, with Circular No. 11F., dated the 28th July of that year, a report by the Inspector General of Forests on the training of natives for the superior appointments in the Forest Department was communicated to the Local Governmetns and administrations for an expression of their opinion. The result of the discussions which that report called forth was the appointment of a small number of native apprentices, but no attempt was made to establish a Forest School. The plan of establishing a separate institution for that purpose was first sketched by Sir Richard Temple when Lieutenant-Governor of Bengal, in a minute dated the 9th October 1876, and it is in the direction indicated in that minute that the Government of India now proposes to take action.

"The Inspector General of Forests has submitted a detailed report on the subject, suggesting that a Central Forest School be established in the North-Western Provinces. After consulting His Honor the Lieutenant-Governor of the North-Western Provinces on the subject of these proposals, the Governor General in Council has decided to make a commencement at once. At first the school will be utilized for the training of officers for the executive branch of the service; it is hoped, however, that eventually, when a perfect system of management shall have been introduced in the forests attached to the school, it will be possible to advance a step further, and provide also for the professional education of candidates for the controlling branch of the service. At the outset, the Forest School is only intended for the provinces under the Government of India, but should the Governments of Madras and Bombay desire it, arrangements will eventually be made to admit a limited number of students selected by the Conservators of Forests in those Presidencies. In the provinces under the Government of India, the separation of the Controlling and Executive Staff is not yet complete, but, as a rule, executive charges are held by Junior Assistant Conservators, Forest Rangers, and superior Foresters. The Forest School will at first only be used to educate candidates for the appointment of Foresters or Forest Rangers. None but natives of India will be admitted as students, and successful candidates will, at the close of their education, obtain a certificate which will be called the Forest Ranger's certificate. To attain these objects, it is necessary to set apart a number of forest districts in a central position under a separate Conservator to serve as model forests and to be used for the instruction of the candidates. The Governor General in Council accordingly directs that the Forest Divisions of Dehra Dun and Jaunsar situated in the Meerut Division of the

North-Western Provinces, and comprising also the leased forests of the Native State of Garhwal on the Tons and Jumna rivers, as well as a small portion of the forests leased from the Bashahr State, shall be placed under a separate Conservator of Forests, and attached to the Forest School. These forests present a great variety of vegetation, while such of them as are situated in the hills have an additional advantage in being composed of trees similar to those of Europe, so that a regular system of management can at once be established, based upon the long experience which has been gained in the forests of Europe.

"The Conservator of the School Forests will also be Director of the Forest School: and Captain F. Bailey, R.E., the Superintendent of Forest Surveys, has been selected for the post. As a temporary measure, he will continue to hold the appointment of Superintendent of Forest Surveys in addition to the duties now assigned to him; but as, under this arrangement, he will no longer be able to give his time entirely to the work of the surveys, it has become necessary to strengthen the staff of officers under him to some extent, by attaching an additional sub-Assistant Conservator to the Survey and Branch. The records of the Forest Survey Branch will be kept quite separate from those of the school and its forests, and the relations of the Superintendent of Forest Surveys to the Inspector General of the Forests and to the Surveyor General will remain unchanged. The Forest Survey Branch is at present engaged in making surveys of several important forest districts in the North-Western Provinces, and in accordance with previous orders on the subject, the Superintendent of Forest Surveys will conduct all work within the territories subject to His Honour the Lieutenant-Governor, under the control of the Government of the North-Western Provinces. Eventually, it may become necessary to separate the appointments of Superintendent of Forest Surveys and Conservator of the School Forests, but at present it is convenient to unite them in one officer. In his capacity as Conservator of Forests and Director of the School Captain Bailey will be entirely subordinate to the Government of the North-Western Provinces. There will, therefore as a temporory measure, be three Conservators of Forests in the North-Western Provinces and Oudh, whose charges may conveniently be designated as the Forest School Circle, the Central Circle, and the Oudh Circle. Experience must show whether, eventully, the two last-named charges may not conveniently be united. Until the organization of forest charges in the North-Western Provinces has been finally settled, the appointment of Deputy Conservator of Forests of the 1st grade on Rs. 900 per mensem, now held by Captain Bailey, will be kept in abeyance, but in lieu of it an additional appointment of Conservator of Forests of the 4th class on a salary of Rs. 1,000 per mensem is sanctioned, and will be held by Captain Bailey.

"The Governor General in Council is of opinion that the selection of the candidates who may be sent to the Forest School to be trained, should be in the hands of the Conservators of Forests, who will act in this matter under such orders as may from time to time be issued by the Local Governments and Administrations under whom they are serving. The suggestions contained in paragraph 45 of the Inspector General's report regarding the qualifications that should be required from candidates are generally approved; but His Excellency in Council is of opinion that all candidates should possess a sufficient knowledge, either of Hindustani or of English. It must be distinctly understood that Conservators should in no way be required to send to the school any forest apprentices if the means exist in their own province for giving them the necessary professional training. Should it, however, be considered desirable to send them, arrangements must be made for keeping appointments available for such candidates sent from the province as may succeed in obtaining a Ranger's certificate at the school. Captain Bailey will assume charge of the forests assigned to the school on the 1st September next; but as it will not be possible by that date to organize the staff proposed to be formed, and to complete all other necessary arrangements, it is not considered desirable that students should be received into the school before the 1st June 1879. Should, however, any Local Government particularly desire that a few promising students should be sent to the school, Conservators may be directed to apply to the Director, who may, if arrangements are sufficiently advanced, as a special case, receive a few students during the current year. Forest administration in India is not yet sufficiently established to justify the expectation that students will be willing to pay for the education which it is proposed to provide at the Forest School; on the contrary, it may in some cases be necessary to give advances of money to enable them to pursue their studies. Such advances may be granted under the authority of the Local Governments and Administrations, but due arrangements should be made for recovering the money so advanced. In order further to facilitate the studies at the school of any candidates who may be exceptionally promising, and who might otherwise be unable to attend, eight scholarships at an aggregate outaly of Rs. 120 per mensem, will be sanctioned; and it will at the outset be the most convenient arrangement if Local Governments and Administrations will communicate with the Inspector General of Forests regarding the grant of scholarships to any candidates who may be specially deserving of such assistance. It is intended that eventually fees shall be charged for the instruction given at the school. In paragraphs 49 to 62 of his report, Mr. Brandis has suggested the conditions and date for the admission of students, the course of studies to be pursued, and the expectations to be held out to those who obtain the Forest Ranger's certificate. These suggestions are generally approved, subject to such modifications as further experience may render necessary.

"In order to secure efficient professional supervision over the working of the forests attached to the school, and the training of candidates, a Board of Inspection will be formed, consisting of the Inspector General of Forests as President, and two members, one of whom will always be a Conservator of Forests. Dr. Schlich, Conservator of Forests in Bengal, and Mr. J. S. Gamble, Assistant to the Inspector General of Forests, are appointed members of the first Board of Inspection. The Governor General in Council directs that the permission granted under paragraph 25 of the Forest Department Code to the Conservator of Forests in Bengal, to charge his *bona fide* travelling expenses, instead of the usual travelling allowances of a Conservator of Forests, shall be extended to the journeys he may make outside the limits of his province, on business connected with the Forest School under proper authority. His Excellency in Council directs that the Inspector General of Forests, as President of the Board, shall submit the reports and suggestions that may be recorded by it, or by any of its members to the Government of the North-Western Provinces, with whom it will rest to pass orders thereon, or to submit them for the orders of the Government of India. On matters of professional detail and the training of candidates, the Conservator of the School Forests and Director of the School may, if the Government of the North-Western Provinces should see fit to do so, be permitted at any time to consult the Board of Inspection through its President. The Government of India will from time to time, in communication with the Government of the North-Western Provinces and the Government of Bengal, arrange when the Board of Inspection shall assemble; the first meeting of the Board will be held in the autumn of 1878.

MINERALOGY.

THE miner who accompanied Mr. Brough Smythe, to report on the gold-producing capabilities of the Neilgherry districts, has cursorily examined the neighbourhood of Nunjanad. It is his opinion that the quartz lying broadcast in this locality contains gold in paying quantities. A detailed examination will be made after the return of the exploring party from the Wynaad.

BARONGA COAL.

To Lieutenant-Colonel E. B. Sladen, Commissioner of Arakan,—dated May 17th, 1878.

SIR,—I have the honor to acknowledge the receipt of your letter No. ——(General) dated 11th May 1878, and to thank you for sending a copy of Mr. Redwood's opinion on the Baronga coal. It had been a disappointment to me that the locality of this coal had not been shown to Mr. Mallet; and thinking, from the trouble taken about the coal, that the locality might have been discovered since Mr. Mallet's visit I telegraphed for the information with a view to adding a last record to Mr Mallet's report, which had just been passed for press. Your answer by wire has informed me that the locality is still unknown.

2. I do not find anything in Mr. Redwood's report to affect the opinion given in my letter of 20th December 1876, except perhaps where the presence of vegetable structure in the coal is questioned; and here I am certainly correct, at least in the sample sent to this office, and which is now in our cases, the woody fibre is perfectly distinct throughout. It was principally from this character that I applied the appropriate name "lignite" to the coal; for having given its composition, the rank it should take as a fuel was sufficiently fixed, and from that point of view, the discussion about the name to which Mr. Redwood attaches such importance, is an idle one. The heating quality of the coal having been determined, the one important question was the supply, and from that geological point of view the name lignite (fossil wood) has a momentous meaning; for coal seams are seldom, if ever, made up of fossilized stems of trees. These occur as isolated logs and their presence is rather against than in favor of productive seams being found in the same measures.

3. Nor can I attach the same high importance as Mr. Redwood to the results yielded by distillation Coal tar and ammoniacal liquor are abundant as the waste products of other manufactures, or as the only result to be got from the waste of coal mines. The suggestion to open coal mines principally with a view to these articles is, I should think impractical.

I have the honor, &c.,
H. B. MEDLICOTT,
Supdt. Geogl. Survey.

The Planters' Gazette.

TEA.

FROM Kotaghery, we learn that many new tea gardens have been lately opened, and that the tea enterprise is likely to be successful in that part of the Neilgherry district.

J. B. JOHNSTONE, a grocer in Blairgowrie, is trying to push Indian tea in Perthshire—a very commendable object in its way, though Mr. Johnstone draws on his imagination somewhat for his facts, judging from the following announcement in his advertisement in the Blairgowrie *Advertiser*:—"It is well-known that all high-class teas are those which are gathered in early spring, when the leaves are succulent—these are first-crop teas, full flavoured and rich, whereas low-priced teas are gathered, or rather raked from under the trees in autumn when the leaves are withered, dry, and sapless."

A CORRESPONDENT in Kumaon writes. "We too have had our infliction of locusts which did considerable damage to the millet and pulse crops. The rice was very partially attacked. Former flights were rather abstemious compared with the last lot which arrived on the 16th July, and have been going and coming ever since. Even now hundreds of them are hovering about, seeming as if the lines had fallen to them in a very pleasant place where they thought of a permanent settlement! In former visits the tea bushes were almost entirely free from their attention, but this year I have seen hundreds of bushes with their leaves stripped by them. The bushes so attacked were very young ones, whose leaves being more tender than the older ones seem to have tempted them to try their teeth on them. A colony of some hundred minas have been luxuriating in fresh locusts daily since their arrival."

"FERMENTATION" OF TEA. WHAT IS IT?

UPON this subject Mr. Chas. H. Lepper sends the following letter to the *Tea Gazette* :—

I noticed in one of your Numbers, the remark that orders had been sent out to managers of factories, to the effect that "high fermentation" should be obtained, *together with* strength and pungency of liquor, and also one or two other impracticable suggestions, that could only have been given under conditions of ignorance on the part of those suggesting them. May I hint that it is this ignorance, on the part of the planters' patrons, of the very rudiments of the manufacture of the article, that causes so much misunderstanding between the patrons and those patronised. Such ignorance is the source of orders, anticipations, expectations, and hopes that should never be given or entertained, and would never be so given or entertained, were many simple truths regarding manufacture but generally known. Were the large home-buyers acquainted with the details of manufacture, they would know what and how much they should expect, and would moderate their demands within the bounds of the possible, and thereby withdraw much anxiety from planters and much needless and groundless suspicion of mismanagement.

I am not speaking here of the ignorance of the general home-public, but may mention *en passant* that, when at home in 1875, I still found it the common impression that the different classes of tea, *i.e.*, Pekoe, Pekoe Souchong, Souchong, &c., were all the produce of different descriptions of tea-plants! Further, when I attempted any enlightenment, I found the belief so firm and so prejudiced that the fact of the different classes being produced from the same bushes, and their different appearances due simply to sieving, &c., was stigmatized at once as a "trick of the trade," "quite a fraud"! This speaks for the "general public."

The orders you mentioned in your Editorial Notes, though quite as absurd in fact, are perhaps less pardonable, as coming from those whose direct orders it is the planters' duty to try and carry out. When these orders are impracticable, he gets the blame for not doing as he is told! Such is the present state of the industry! There is yet another class of ignorance,—and here I am treading, I am fully aware, on not only debatable ground but dangerous ground—I mean that ignorance of cause and effect that exists amongst planters themselves, and from which ignorance I in no way claim to be exempt.

Let me take as one example of this, the process, or say fact, of so-called "fermentation" already alluded to above. Planters know that "fermentation" softens down and deadens the liquor, and that if they "ferment" highly, they cannot help depriving their tea of much of its "rasp" They know that if their teas are intended for mixture with Chinese teas, they must "under-ferment" and obtain full strength and pungency, whereas, if their teas are intended to be sold alone, they know such "under-fermentation" would render them undrinkable, and that, in consequence, they must "ferment" to a considerable extent to overcome the too harsh character of Assam growths. Coming to the brokers, test of "fermentation," *viz*, the colour of the leaf after infusion" they know that—

1st.—In the beginning of the season, when the weather is cool and the air and soil comparatively dry, and the sap cannot, from its absence, be expressed in the rolling process, they know, or say have noticed the fact, that the desirable "light salmon colour" is hardly procurable save to those who "know a dodge or two." That, instead, they find the leaf assumes a dark olive colour (actually often reported on as "over-fermention!"), which is both ugly and very undesirable.

2nd.—They will have noticed that on hot dry days, after a period of drought in the hot weather, the balls put to "ferment" by those who go in for balling, assume a black appearance on the outside and may be quite "unfermented" in the inside.

3rd.—That once the leaf is put over hot fires, "fermentation" ceases.

4th.—That the sign of "over-fermentation" is a darkened or dark copper colour appearance on the infused leaf; *not* a dark olive, as given in note!

5th.—That "excessive fermentation" results in the leaf going sour before it is put on the fires; to avoid which, the leaf is often put on the fires and half-cooked to check fermentation, and then taken off till all the day's tea is so checked; and finally finished off when all the day's leaf has been half-fired.

6th.—That the interiors of the balls in the process of "fermentation" undoubtedly heat and generate a gas or gases, probably carbonic acid mixed with other ingredients. Carbonic acid gas has no smell, and this gas or these gases has or have a strong smell.

7.—That "fermentation' requires sap in the rolled leaf, warm atmosphere, and pressure and contact, to ensure evenness, and rapidity, and that the leaf exposed to the air and light, unless the "fermentation" is going on rapidly from the interior, as under favourable conditions of sap and weather, becomes of a darker and green olive than the interior which may be properly fermented and of the proper colour.

8th.—That to produce this "fermentation," the leaf must previously have been rolled, or say masticated, to express the sap and bring about conditions suitable to the chemical action that it is desired to set up,—call it "fermentation" if you will.

Now, Sir, before I go any further, let me say that I am most certainly not writing with any intention of *giving* information, save only in so far as this letter may produce intelligent replies from more enlightened sources. I am no chemist, and am asking for information. As there are no chemists that I know of acquainted with the process of tea-manufacture, I have thought it best to put the process of so-called "fermentation" in a definite shape before such chemists as may feel interested, and chose to enlighten us as to what really does take place during the process.

From all the planters that I have asked, notwithstanding they employ the process daily, and have noticed all the facts above detailed, I have not been able to get any answer to my question of "What goes on?"—"Suppose it's fermentation," and there it ends! It appears to me that scientific men hearing practical planters, merchants, &c., speak so decisively of "fermentation," have never doubted that fermentation does go on, not having themselves seen the process: and hence our present erroneous term for the process.

It is clearly *not* fermentation for several reasons, nor is it oxidisation, for the reason that the oxidised leaf is the olive-coloured leaf, in distinction to the salmon-coloured, and found to prevail on days when "fermentation" is slow owing to unfavourable weather, &c., and the leaf is long exposed to the air; the oxidised leaf, judging by this test of colour, is found on the *outside* of balls or heaps undergoing the process, and is chiefly quite different from the reddish brown, or dark copper colour caused by "*over-fermentation*." If I might hazard an opinion in advance, I think it will be called a modified form of spontaneous combustion, and this is brought about by the macerating process, which, by expressing the juice and disruption of particles, accelerates decay, and with heat generates gas or gases just as in the case of a hay-stack that has been stacked when damp.

I believe that real fermentation *could not* set in, in the time and under the conditions now allowed for the process. It must be remembered that the leaf is often, in suitable weather quite sufficiently "fermented' in three minutes—and as much so as, under unfavourable circumstances, might take an hour! Is it possible that fermentation can set in in three minutes—and that without the addition of its germ or germs, save in so far as it or they might be attracted from the atmosphere,—there being no foreign water added to the natural juice, or brought in contact with the leaf?

Were the leaf spread thin without being rolled or masticated, without any expression of juice, decay would *follow* oxidisation, not *precede* it, as it precedes it in our process, and would of course be a lengthy process in comparison; and would certainly totally unfit the leaf for manufacture. I am inclined to think decay setting in *before* oxidisation, accelerated by the assistance of water (the free juices), sets up a violent chemical action accompanied by the phenomenon of heat that, being allowed to go certain lengths without going too far, affects the tanning in the leaf and softens thus the liquor as the result.

This leads me to believe that the leaf after rolling should not be allowed to remain about, scattered thin, or with a large quantity or say surface of a heap, exposed to the air, as being likely to produce oxidisation instead of decay, *i. e.*, the olive-green instead of the salmon colour, and the more of the former there is, the more uneven the "fermentation" will appear of course.

The only thing I can advance against my theory in practice is that hot, damp air dispersed through rolled leaf on cold dry days, when there is also a want of sap, and "fermentation" happens to be slow and unsatisfactory, produces quick and even "fermentation;" yet I doubt if this does not rather endorse my theory than otherwise. For instance, might not the previous masticating or rolling process have so started the particles on their way towards the "stable equilibrium" of inorganic compounds, that when damp heat is added, the process goes on quicker than oxidisation can set in, notwithstanding the dampness of the air, which dampness is necessary to prevent the drying up of the scarce sap, and the thereby stopping of the process of decay.

We know that heat assists chemical action by increasing the distance between the centres of the particles, and that water assists by diffusing them: hence a deficiency of either will act as a check on a process depending on chemical action; hence the tardiness in decay on cold, dry, days is aggravated when there is also a want of sap,[*]—this tardiness sometimes being so protracted, that oxidisation sets in the first of the two, and the olive-green appearance is the result, which once obtained the whole process seems affected, as the salmon-colour will never come to the leaves so oxidised, and it is useless waste of time waiting for it.

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[*] SAP.—It must be remembered that the fluid usually called the sap should be called by the plural, as the sap of the veins is different to the sap of the cells; and that we have strong tannic acid with all.

These saps being different, when mixed by the rolling process and expressed, set up a strong chemical action, and produce the phenomenon of heat, which heat accelerates the decay. The result forms compounds, that of the interior of the ball being unoxidised and of a salmon colour, and that of the outside of a dark-olive colour and oxidised, and of perceptibly different quality to the other.

Although I have here advanced a theory in order to create discussion, I am quite open to conviction, and shall be only too glad to be corrected if wrong, as, whatever this process may be, be it fermentation, or be it rot, I am quite alive to the importance of having it under command by understanding thoroughly its real principles.

TEA-DRYING BY SOLAR HEAT.

ONE of the greatest difficulties that the Indian tea planter has to contend with is to procure fuel for the several processes of drying and "firing" the leaf. The only fuel that is used for those purposes and as far as is known, the only that can be used, is charcoal. When the land is first cleared, the trees that have been felled furnish the necessary fuel, but when this supply has been once exhausted, recourse must be had to the neighbouring forest, which not only entails a great increase of cost, but has the further disadvantage of denuding the hills of trees and thus seriously diminishing the rainfall. This difficulty is referred to in Simmonds' well known work on *Tropical Agriculture.* He says:— "Perhaps one of the most vital questions to the planters of the future "is the fuel supply. At present all the firing operations are carried "on by means of the charcoal obtained from the forest which is cleared "for the tea ground, or which grows on those parts of the several "grants which are not under cultivation. It is obvious that the "destruction of timber must be enormous, and at no distant period it "will have to be decided how to manufacture tea with cheaper fuel than "charcoal. The invention of such a method would be a great boon."

No one having discovered or invented any other fuel that will answer the purpose so well as charcoal, inventive ingenuity has been brought to bear to economise the consumption, and so stave off the time as far as possible when tea cultivation in India will have to be abandoned through lack of fuel, or the labourers will have been exterminated by famines produced by droughts occasioned by the destruction of forest trees. Within the last few years several specifications of inventions have been filed for improvements in drying tea, most of which have had for their principal object the economisation of fuel but it has been reserved for Mr. Adams of Bombay to discover a method by which, as he affirms, all the operations of drying and "firing" tea can be effected without any fuel whatever. If he can succeed in performing the promise contained in his advertisement, the tea planters, not only of India, but of every part of the world where the leaf is cultivated, will be indebted for a far more valuable "boon" than that imagined by Simmonds. Not only the tea planters and the shareholders in tea companies will benefit by Mr. Adams's idea, but, ultimately, all the lovers of "the cup which cheers but not inebriates," because diminished cost of production will very materially reduce the price of the leaf in the markets.

How far he is justified in his assertion that, by his plan of concentrating solar heat, tea can be dried without any fuel at all, is, perhaps, only known to himself; but from the results of the experiments made by him in the concentration of solar heat, which were witnessed by several people in Bombay, it is probable that his idea is far from impracticable. His pamphlet on the "Utilization of Solar Heat," which he has just published (and which has experienced scarification at the hands of those of our contemporaries who have taken the trouble to notice it), however bad it may be as a literary production, gives data which, if not exactly warranting his sanguine anticipation of driving spinning mills by solar heat, affords strong grounds for believing that solar rays can be very extensively utilized. The fact that thirty-two gallons of water, boiled by solar heat reflected from a few panes of silvered window glass in about as many minutes, at 8-30 A.M., as was done in presence of several spectators in Bombay, affords a vehement probability that a very large quantity of tea leaves could be dried or "fired," by the same means, in a very short time. Another reason for believing that the inventor is not without good grounds for believing in the practicability of his invention, is the fact that the Directors of the Bombay Sassoon Mechanics' Institute have awarded the Berkley Gold Medal and Rs. 250 to him for his essay on the subject. By the rules of the Institute, this gold medal, a handsomely engraved disc of pure gold, weighing nearly five ounces, is only conferred, as a substitute for a silver medal when the essay, or model of an invention, sent in for competition, is considered by the committee to be deserving of extraordinary recognition. It is, we believe, the second that has been awarded since the die was engraved, and lodged in the Bombay Mint in 1861, and the Committee, in which there is a large proportion of Scotch and Hebrew gentlemen, wisely elected by the members to ensure the economical expenditure of the funds, would not have awarded so costly a prize without good reason. In essays submitted to such institutions as the Bombay Sassoon, merits or demerits in point of literaray style are very properly ignored, otherwise Mr. Adams' medal, if any, would have been of leather instead of gold. He will have redeemed the sin of having written a bad book, an offence exceedingly prevalent, if his invention turns out to be a public benefit. The number of those who can invent or discover anything that will benefit mankind is very small, whilst the supply of writers, and, we fear, of orators, will always be greatly in excess of the demand.—*Bombay Gazette.*

TEA FROM CEYLON.

SOME thirty years ago it might have seemed highly irrelevant and inconsequent to couple the name of Eastern India with the cultivation of tea, though it is to-day almost universally admitted to produce the finest growths in the world. Most people are, however, probably aware that the saleable value of its high class teas has been considerably damaged by a series of ignorant mistakes which may never be wholly rectified. The Indian Government of 1840, unaware that the tea-plant existed under its own eyes in higher perfection than anywhere else, actually congratulated itself at being able to import seeds from China at the expense of much time and labour. This was done so freely and in such enormous quantities that by the time the indigenous plant was recognised, with its peculiarly valuable qualities of strength and flavour, it was in a measure swamped, and a species vastly inferior and almost entirely Chinese had been produced and widely propagated. The non-commercial and uninitiated mind may feel surprise in learning that Ceylon (for so long connected with coffee) possesses like India the right natural material, which labour is only now, however, beginning to fashion and embody in a fixed utility in the shape of tea. But amongst planters the only matter for surprise is that the idea did not suggest itself earlier, and that the cultivation of the tea-plant should still be in such an elementary stage. Whilst most people continue to look on Ceylon as a land of coffee and spices, it has been practically and satisfactorily demonstrated that it possesses over India very important advantages for tea growing in the matter of locality, soil, and climate. There are districts above and below the coffee-bearing altitudes which are eminently suitable for tea. In the higher the same amount of wind likely to inflict serious injury on the coffee blossom, serves to heighten the flavour of the tea; while in the lower the absence of wind and the consequent loss of flavour are compensated by the more abundant flushes of blossomings. In the south of the island there are numerous tracts of these high and low waste lands, which have hitherto been left uncultivated, as being unfitted for coffee. These southern districts have been most favourably reported upon, and there is already ample proof that they are peculiarly well suited for successful production on a large scale. Ceylon has indeed been shown to be so admirably adapted for the cultivation of tea, that the people whose interest and money are vested in coffee are, with one accord, turning their attention to tea-planting as a supplement, if not a substitute. A practical planter from Assam writes:—"The soil is good, and the climate all that can be wished for; warm and moist, and well suited for producing numerous flushes." Already the produce of these plantations has been very highly thought of abroad and at home. The local price averages 3*s.* 3*d.* a pound, and the increase of production in five years on the estate is very large. It is probable that in some of these estates yearly flushes to the amount of 700 pounds of clean tea per acre may be easily produced. It must be remembered that those results have been arrived at without any aid from machinery. When this is introduced there will, of course, be a proportionate reduction in the difficulties and losses unavoidable in any primitive mode of manufacture. There are besides other important factors which must aid in the speedy success of the enterprise, of which not the least is a certain amount of cheap labour, unattainable for any length of time in Assam. Ceylon has so long held a reputation for the produce of coffee that a talk of it as a rival to Assam, still sounds strange and unfamiliar. Yet we confidently believe that, as far as quality is concerned, it may surpass even the far-famed Indian teas. We have spoken of the value they have undoubtedly lost by the too free admixture of Chinese.

Now the felled forest land in Ceylon has been all planted with Assam seed, with just enough blending to produce a high-class and valuable hybrid, giving Ceylon a good start over India, which is yet heavily handicapped in the realisation of her profits. There can be no doubt that, as a means of utilising waste land, as well as a sure speculation, the cultivation of tea in the island opens up a wide field for commercial enterprise. If the tea industry of Ceylon is still in embryo, it is notwithstanding a great reality; and as events are daily proving that a better and safer investment for capital can hardly exist, the subject ought to be one of high interest to the mercantile world.—*London.*

TEA IN DARJEELING.

THE weather has been very favorable for tea as well as for tea planters and everybody else. A good deal of rain has fallen, but it has come down at night principally. The warm sunny days have been most favorable for tea and as an Irish friend remarked, "one can almost hear the flush growing."

Red spider seems to have ceased its ravages in this district. It has been noticed that tea bushes which were allowed to "run" and grow a quantity of new wood at the beginning of the season have either not been attacked at all, or so slightly as to have suffered but little from the attacks of spider. It has also been noticed that bushes planted on stiff, clayey soil have escaped much better than those growing in light, dry soil.—*Darjeeling News.*

COFFEE.

A NUMBER of small plants of Liberian coffee, received at Mauritius recently in a Wardian case, when put up at auction there realised an average of Rs. 15 each.

LIBERIAN coffee has been introduced into Siam. One hundred and fifty coffee plants and a large quantity of seeds have been imported in view to a distribution being made among those who wish to try experiments.

MESSRS. JAMES IRVINE & Co., of Liverpool, write to a Ceylon paper to advise receipt of a letter from their correspondent in Monrovia, in which he states that "the prohibitory act on coffee seed and plants will not be passed until the next session of the Liberian Legislature. Through the influence of the late Dr. Dunbar, who was a member of the Legislature, the bill was tabled until next December, at which time the act will take effect." In all likelihood additional influence will be brought to bear upon the Legislature before December to quash the act altogether.

UPON the subject of shade a correspondent in the Wynaad writes :—" It is wonderful the evident effect of some kinds of trees as shade ; the coffee seems absolutely to revel under them and spreads out its branches, laden with clean, dark, glassy leaves, which, in themselves, might prove the healthiness of the plant, and refute the idea of leaf manure producing disease. It is a curious fact that one of the trees under which coffee seems unfailingly to thrive is a wild sort of cotton, the stems of which are covered with huge thorns, and which for part of the year is *leafless*, and bears instead masses of gorgeous crimson blossoms, which beautiful as they are, can hardly be of any use as 'shade.' Charcoal, once so beloved, is now pronounced useless, and is ruthlessly destroyed, but has many lives, and springs up so determinedly wherever it has once settled that it has almost taken its place amongst the abhorred category of ' estate weeds.' "

THE *South of India Observer* says that nowhere in India can more satisfactory results be shown, than can be adduced with regard to every staple of produce that has yet been cultivated on the Neilghery Hills. The coffee properties on these Hills are noted everywhere as bearing away the palm. Notwithstanding leaf disease and irregular seasons, the proprietors of coffee estates in this district have been enjoying uninterrupted success. Such estates as have changed hands, have realised prices surpassing even the enormous rates given in Ceylon in favoured districts. Rs. 1,000 per acre for coffee in bearing is a current quotation, and many men can be pointed out, that landed in India with the proverbial shilling in their pocket, who have made a fortune It is true that there is not very much land left suitable for coffee on the Neilgiris Proper, but there is plenty of fine land on the slopes of the Hills, and in the Valleys adjoining, which could be worked from the Hills above, the Managers of which would be Hill residents.

IN MALABAR.

(FROM A CORRESPONDENT)

MALABAR, JULY 31.

THIS sudden stoppage of the rain has caused much anxiety in the coffee districts for the safety of the new plantings, which had been delayed too long from absence of the usual monsoon supply. "It was a busy time,' writes a friend, " whilst the rain lasted; everything had long been ready for planting, and when it came at last, every one belonging to an estate was set to work. On one occasion I found a lady, whom I had always thought almost too fragile to bear the breath of the summer breezes, attending to the lifting and despatch of plants from the nursery. It was blowing half-a-gale and raining torrents. Her delicate feet were encased in a pair of her husband's Wellingtons, with a large sombrero on her head, which, if she had intended to study the becoming, had the desired effect. A servant held a widespread umbrella over her. I asked if that servant could not attend to the work, instead of her standing out in the wet and cold? 'Yes,' she replied, 'he could, if he would ; but if I turned my back for a moment, he would hide in one of the huts all day, and then report, All right. Because, you know, that this year plants are scarce, and therefore more valuable. The coolies have a habit of dropping some in the jungle on their way up, to be picked up afterwards and sold. Therefore, as every one must do something, I am placed here at the easiest work.'

COFFEE AND TEA CULTIVATION IN THE MADRAS PRESIDENCY.

THE following interesting statements have recently been submitted to the Government of India by the Madras Board of Revenue. Coffee cultivation is carried on in the districts of Malabar the Nilgiris, Salem, Tinnevelly, Madura, Coimbatore and Vizagapatam, and tea cultivation on the Nilgiris alone. The Commissioner of the Nilgiris has not given the cost of coffee and tea cultivation, owing it is said to the difficulty of procuring trustworthy information. He has been requested to report approximate figures. The Resident at Travancore was requested to obtain information regarding the extent of coffee and tea cultivation in the Travancore and Cochin territories and the exports of coffee to Foreign countries and ports in British India from the port of Kolachal in Travancore. He has reported that the Diwans of Travancore and Cochin have not yet furnished the information.

The figures now given by Collectors differ from those entered in the crop statements already furnished by Collectors as shown below :—

1875-76.

District.	Area in Acres as given in the Crop Statements.	Area in Acres as given in the Coffee and Tea Returns.	Excess of Column 3 over 2.
1	2	3*	4
Coffee.			
Vizagapatam	...	6½	+ 6½ (*a*)
Madura	961	2,162	+ 1,198 (*b*)
Tinnevelly	2,099 †51	2,011	— 142 (*c*)
Salem	...	4,576	+ 1,576 (*d*)
Malabar	33,167	37,304	+ 4,137 (*e*)
Coimbatore	811	765	— 46 (*f*)
Nilgiris	12,593	12,593	...
Tea.			
Nilgiris	2,392	2,392	...

1876-77.

District.	Area in Acres as given in the Crop Statements.	Area in Acres as given in the Coffee and Tea Returns.	Excess of Column 3 over 2.
Coffee.			
Vizagapatam	...	6½	+ 6½ (*g*)
Madura	998	2,284	+ 1,286 (*h*)
Tinnevelly	2,117 †51	2,095	— 76 (*i*)
Salem	9,69	4,784	— 4,885 (*j*)
Malabar	35,312	41,479	+ 6,167 (*k*)
Coimbatore	575	795	+ 220 (*l*)
Nilgiris	13,618 ‡6,806	13,618	— 6,306 (*m*)
Tea.			
Nilgiris	3 112	3,142	...

* The figures shown in this column are exclusive of land taken up, but not planted.
† Belongs to Zemindaries
‡ Belongs to south-East Wynaad transferred from Malabar to Nilgiris.

(*a*) 6½ Acres of coffee cultivation are in the Vizianagram Zemindri ; the crop statement does not take account of Zemindari cultivation.

(*b*) The excess is *probably* due to cultivation in Zemindaries not included in the crop return.

(*c*) 54 Acres cultivated in Zemindaries are not taken into account in the crop return. The reason for the remaining differences is not known. The Collector is requested to explain.

(*d*) In the crop statement coffee cultivation was entirely omitted by the Collector. The omission should be explained.

(*e*) The difference should be explained.

(*f*) The difference should be explained.

(*g*) Same as (*a*).

(*h*) Perhaps due to Zemindari cultivation not being included in the crop statement. The Collector should explain.

(*i*) The difference should be explained.

(*j*) In the crop statement the Collector has evidently included also land taken up but not planted. This is 4,896. The balance on the other side is probably due to inclusion of Zemindari cultivation.

(*k*) & (*m*) The Collectors have included the South-East Wynaad in Malabar instead of in the Nilgiris. The cultivation for the two districts taken together as shown in both statements are nearly equal, *viz.*, Crop Statement 54,760 ; Special Statement 54,621. The slight difference of 139 acres cannot be accounted for.

(*l*) Same as (*f*).

Statement illustrative of the state of Coffee Cultivation in the Madras Presidency for the official year 1875-76.

DISTRICT.	Number of plantations.	Approximate average elevation.	AREA IN ACRES.				Approximate yield in lbs.	Average yield in lbs. per acre of mature plants.	Cost of cultivation per acre in the Province.
			Mature plants.	Immature plants.	Taken up for planting but not yet planted.	Total.			
1	2	3	4	5	6	7	8	9	10
1. Vizagapatam—									Rs.
Bonunghy Taluq	9	From 3,000 feet to 4,000 feet	5	1½	......	6½	1,940	388	76
2. Madura—									
Dindigul Taluq	244	4,000 feet	1,003	122	......	1,125	674,016	672	108
Pulni	520	4,500 "	432	404	......	836	311,040	720	108
Periacolum	62	3,500 "	21	180	80	281	2,980	142	85
Total	826	....	1,456	706	80	2,242	988,036	678	105
3. Tinnevelley—									
Tenkasi Taluq	18	From 1,000 feet to 3,000 feet	1,089	184	599	1,872	283,046	260	30
Ambasamudram Taluq ...	2	300 feet	21	1	......	22	20,090	980	65
Nanguneri	20	From 1,000 feet to 2,500 feet	698	18	......	716	440,098	630	32
Total	40	....	1,808	203	599	2,610	743,234	411	31
4. Salem—									
Shevaroy Hills	286	From 4,000 feet to 4,500 feet	3,432	1,144	4,954	9,530	1,716,000	500	130 to 150
5. Malabar—									
Kottayam Taluq	7	300 feet	23	5	10	38	7,591	330	100
Kurumbranad "	22	400 "	81	16	43	140	50,625	625	40
Wynaad "	14,521	From 2,400 feet to 4,700 feet	27,499	9,330	22,200	59,029	5,499,700	200	250
Ernad "	9	" 1,000 " " 1,500 "	51	5	32	88	10,710	210	50
Walluvanad "	79	" 100 " " 1,000 "	103	161	......	264	8,446	82	125
Palghaut "	7	1,000 feet	30	......	......	30	2,278	76	150
Total	14,645	....	27,787	9,517	22,285	59,589	5,579,350	201	249
6. Coimbatore—									
Pollachy Taluq	3	From 4,000 feet to 4,700 feet	195	50	1,310	1,555	80,470	412	55
Coimbatore "	12	Not ascertainable	406	114	38	558	121,692	300	75
Total	15	....	601	164	1,348	2,113	202,162	336	60
7. Nilgiris	126	From 3,000 feet to 6,000 feet	10,163	2,430	6,426	19,019	3,281,821	323	Not known.
Grand Total	15,947	....	45,252	14,165½	35,692	95,109½	12,512,546	......	......

Statement illustrative of the state of Coffee Cultivation in the Madras Presidency for the official year 1876-77.

1. Vizagapatam—									Rs.
Bonunghy Taluq	9	From 3,500 feet to 4,500 feet	5	1½	......	6½	1,380	276	76
2. Madura—									
Dindigul Taluq	244	4,000 feet	1,002	121	......	1,123	448,896	448	108
Pulni "	637	4,500 "	735	225	677	1,637	411,600	560	108
Periacolum "	62	3,500 "	21	180	80	281	3,272	156	85
Total	943	....	1,758	526	757	3,041	863,768	491	105
3. Tinnevelly—									
Tenkasi Taluq	18	From 1,000 feet to 3,000 feet	1,172	184	516	1,872	269,082	229	30
Ambasamudram Taluq ...	2	300 feet	21	1	......	22	20,090	980	65
Nanguneri " ...	20	From 1,000 feet to 2,500 feet	717	......	......	717	449,268	626	31
Total	40	....	1,910	185	516	2,611	738,435	386	30
4. Salem—									
Shevaroy Hills	290	From 4,000 feet to 4,500 feet	3,588	1,196	4,896	9,680	1,794,000	500	130 to 150
5. Malabar—									
Kottayam Taluq	7	300 feet	23	5	10	38	7,591	330	100
Kurumbranad "	22	400 "	91	72	223	386	56,610	623	40
Wynaad "	15,165	From 2,400 feet to 4,700 feet	29,937	10,977	27,500	68,414	5,987,400	200	250
Ernad "	9	" 1,000 " to 1,500 feet	51	4	32	87	10,710	210	50
Walluvanad "	83	" 100 " " 1,000 feet	113	173	......	286	9,275	82	125
Palghaut "	7	1,000 feet	30	......	......	30	2,278	76	150
Total	15,293	....	30,248	11,231	27,765	69,244	6,075,864	201	248
6. Coimbatore—									
Pollachy Taluq	3	From 4,000 feet to 4,700 feet	195	50	1,310	1,555	80,470	413	55
Coimbatore "	15	Not ascertainable	462	88	117	667	110,932	240	89
Total	18	....	657	138	1,427	2,222	191,402	291	63
7. Nilgiris	132	From 3,000 feet to 6,000 feet	11,184	2,434	6,825	20,443	3,560,480	318	Not known.
Grand Total	16,724	....	49,350	15,711½	42,186	107,247½	13,225,329	...	...

Statement illustrative of the state of Tea Cultivation in the ***Madras Presidency*** *in 1875-76 and 1876-77.*

District.	Number of Plantations.	Approximate average elevation.	Area in Acres.				Approximate yield in lbs.			Average yield in lbs. per acre of mature plants.	Cost of cultivation per acre in the Province.	Cost of manufacture per lb. in the Province.
			Mature plants.	Immature plants.	Taken up for planting but not yet planted.	Total.	Black.	Green.	Total.			
1	2	3	4	5	6	7	8	9	10	11	12	13
1875-76.												
Nilgiris ...	33	From 3,500 ft. to 8,000 ft.	1,514	878	641	3,033	220,070	...	220,070	145	Not known.	
1876-77.												
Nilgiris ...	44	From 3 500 ft. to 8,000 ft.	1,514	1,628	2,341	5,483	233,769	2,000	235,769	156	Not known.	

MANURING COFFEE ESTATES.

ONE of the most important subjects, connected with coffee-planting, is manuring. A great diversity of opinion has existed as to the best description of manure which should be employed, and the chemist and analyist have been enlisted in the cause of solving the problem. The results of these enquiries and analyses appear to amount to this, that a combination of manures is necessary. As one eminent chemist puts it, the whole art of manuring consists in adding to the soil those things in which it is deficient at a right time, in a proper chemical condition, and in the requisite proportions. Some planters stake their faith on his manure, and some on that, and will not be persuaded to use any other. This is a serious error and shows how very important it is for every planter to know something of the chemistry of coffee-planting. Having learnt the chemical composition of the coffee-tree, the planter will be able to judge as to the manures he should use, and in what proportion they should be applied. Dr. Shortt, in his "Hand-book on Coffee-Planting in Southern India," gives some very interesting particulars of an analysis he made of a double-stemmed coffee tree, roots and all, and which was fifteen feet high. The result of the analysis was :—

	lbs.	oz.	drs.
Water lost by drying.	7	8	0
Organic matter.	9	13	10½
Ash.	0	6	5½

The 6oz. 5½ drs. of ash gave the following results :—

Potassa	15·76
Soda	18·19
Lime	26·07
Magnesia	4·26
Sesqui-oxide of iron	9·22
Phosphoric acid	13·28
Sulphuric acid	2·79
Chloride of sodium	8·85
Silica	1·29
	100·00

Farmyard manure, as we have always held, is very excellent, but as it is poor in lime and phosphoric acid, it is essential that some other manure, rich in those properties, should be added. One thousand pounds of the dung of grass-fed cattle was found to contain only 3lbs. of phosphoric acid, and 4lbs. of lime. Bones are rich in lime and phosphoric acid, and should therefore be mixed with dung; an admixture of nitrate of potash has also been recommended by some planters. Mr. Robt. H. Elliott employed the three combinations referred to in manuring his estate, and reported that he obtained the most valuable results, Some planters dissolve the bones by sulphuric acid, while others again break them up into small pieces. Mr. Elliott advocated mixing the broken bones with coffee pulp, but it has been found that the pulp has an injurious effect on the tree. As to the mode of applying bone manure, we would recommend to the reader the following receipe drawn up by an experienced planter :—"1lb. of bone is a 'good dose' for a tree ; let the holes be cut 7 inches by 20, and 9 inches deep, and about 10 inches from the tree. Mode of applying, say, one part in bulk to from 2 to 3 of earth, well mixed, and let this be scraped into a heap along the side of the hole nearest the tree. If bone dust and poonac is used, I would say put one part in weight of bones to two of poonac ; put about 1½lb. of this mixture to each tree, and mix with about twice the quantity, in bulk, of earth. This manure will act very well, and put a good crop of both wood and coffee on large trees that require manure. In the space of five years an estate of 200 acres may be manured throughout with bone dust, with the reasonable quantity of 20 tons per year, and many an old estate, especially high places, may be made to look young again with this treatment, and, to say the least will, with additional bearing, do a *little more* than cover the cost of manuring with this fine fertiliser." It is a pity that planters do not experiment more than they do. In the matter of manuring, as in most of the branches of coffee culture, there is room for improvement. We would, in this place, once more invite discussion on such subjects at the meetings of the Planters' Associations, and in the shape of correspondence in the *Chronicle*. Many young planters whose sources of information and advice are otherwise limited, would gladly avail themselves of such opportunities of instruction.—*Madras Times*.

PLANTING-LETTER FROM S.-E. WYNAAD.

20th July 1878.

IT is just as well, perhaps, the monsoon has followed the drought we have been having, so mildly, because it is the very sudden changes from drought to excessive moisture (rain and fog) in my opinion that have been the cause of so much trouble to us, and are, in no small degree, responsible for the ravages of bug, borer, leaf-disease, &c., &c. Leaf-disease, however, up to the present time, is not so bad as it was this time last year, but borer, I regret to say, is committing sad havoc on some estates, one of which has, I am told, had a gang of about forty coolies employed daily cutting down and burning all infested trees. Perseverance and (w)right measures, have done all in their power to ward off these nuisances, but come they will in spite of all we may do. I was in hopes that a panacea had at last been discovered for the abominable leaf-disease. A friend of mine, when I mentioned that it was commencing on parts of my estate, recommended me to try a solution of cow-dung and water in proportion of one to four, and to sprinkle the decoction freely over every leaf. He assured me the application to some thousands of young diseased plants in his nurseries cured them effectually in a very short time. Granted, and I think liquid manure applied outwardly in such a manner does good, particularly to young plants in beds, because it is soon washed off the leaves by watering or rain, and taken into the soil, thus serving the purposes of a remedy as well as food, but to treat acres upon acres of full-grown coffee trees in this way, would require, as I told my friend, oceans of water, thousands of cattle, armies of coolies, and millions of pots and pans, to make, prepare, and convey the fragrant decoction (shugami neeiou) to each tree, a methodical suggestion more laudable than feasible.

The following is a statement of rainfall registered on an estate in this district for the first half year of five years to 30th June :—

	1874	1875	1876	1877	1878
Inches	61·35	41·65	22·35	62·81	30·68

TEA AND CINCHONA.—Both seem to grow well, and many thousands of both species are now being planted out, so I hope in time Wynaad will be able to add her cultivations to the several European entrepots and compete favourably with other tea and bark-producing countries. A planter at Charumbaddie is, I hear, putting out a lakh of cinchonas this season. I imagine they will do better there than coffee.

SEED PACKED IN SPHAGNUM MOSS.

A LETTER from Messrs. Jas. Irvine & Co., dated Liverpool, 19th June, states :—

> "We have at the present moment a bag or two of the finest-looking coffee seeds we ever saw. They have come home in the parchment in bags without soil, moss or anything else, and as an experiment we beg you to accept 25 seeds, which we send herewith packed in moist sphagnum moss and enveloped in waterproof. Will you kindly take the trouble to tell us in what condition they arrive and if any conclusions can be drawn from this mode of shipment?"

The seeds (25) look as if most of them had retained vitality, although, in consequence of the packet being so small, the moisture, had nearly all evaporated from the moss. It certainly seems to us that this mode of packing in good cases would answer well, especially if moss could be obtained in Liberia and rapid transmission ensured. We have had the seeds put in flower-pots, and shall report the result, which we have every reason to hope will be largely successful. Our own consignment, the arrival of which we noticed some time ago, has been practically a total failure. Even the cherry coffee of which so much was hoped failed. A friend who got seed at the same time has been equally unfortunate. Perfectly ripe and well-dried parchment seeds, packed in sphagnum moss, slightly damp, the cases being stout and well secured so as to prevent evaporation, ought, with rapid transmission, to succeed. Hitherto, a very large proportion of consignments have resulted in failure either large or complete. On the other hand, a few consignments have been most successful.—*Ceylon Observer*.

CONSUMPTION AND PRODUCTION OF THE WORLD.

THE *American Grocer* says that "The largest part of the world's supply, and by far the greater portion of the coffee consumed in the United States, comes from the Empire of Brazil. The following table is the latest compiled, showing the amount of coffee used in the various consuming countries, exclusive of the quantity taken for home consumption at points of production :—

	Total Imports. lbs.	Average. per head.
France	98,635,000	2·73
Belgium	49,771,000	13·48
Switzerland	18,779,500	7·03
European Russia	14,740,920	0·19
Sweden	26,555,218	6·11
Norway	17,636,080	9·80
Denmark	26,035,652	13·89
Holland	72,395,800	21·00
Hamburg, Germany	178,715,936	—
Austria, 1871	76,876,576	2 18
Greece	2,131,357	1·42
Italy 1871	28,511,560	1·00
United Kingdom	82,330,928	1·00
United States, 1877	302,938,120	7·04
Total	946,048,652	

"Of the total amount consumed in the United States, Brazil for the past five years has furnished an average of 75 72 per cent. The following table, based on the average importations for five years, shows the proportions of the various kinds consumed :—

Importations from—	Tons.	Per cwts.
Brazil	101,889	75·72
Maracaibo, Laguayra and Porto Cabello ...	11,706	8 70
New Granada and Costa Rica	1,989	1·48
Santo Domingo, Cuba, Jamaica, and Sundries	9,930	7 38
Ceylon and Manilla	691	·51
Java, Singapore, and Java from Holland ...	8,356	6·21
Total	134,561	100·00

"Whole provinces in the Empire of Brazil are covered with forests of coffee trees. The tree flourishes best in localities where the temperature ranges from 62 to 66 degrees Fahrenheit, but in Brazil it grows and yields well in Rio de Janeiro, Minas Geries, Parania, S. Paulo, Santa Catharina, Ceara, &c , all of which are in different latitudes. Coffee raised on the high lands has a more agreeable taste and aroma than that cultivated on bottom lands. The best planters raise the trees from the seeds, transplanting the young bushes within ten to twelve months of the time of planting. The tree generally produces from 1 to 7 pounds of cleaned coffee. The harvesting of the crop commences in April or May, and continues until September. Different processes are used, and are thus described by Dr. Nicolau J. Moreira, one of the Commissioners to the Centennial Exhibition of 1876 .—' 1st. The berries are spread out upon terraces of stone, mortar, or cement somewhat elevated in the centre, and they are kept there until complete desiccation takes place, care being taken to turn them over if it should rain when they are dry, or nearly so. 2nd. Many farmers take the berries when fully ripe, immediately to the press and expose them, after being well washed, to the sun, on terraces or sheds. 3rd. Others put the berries in large tanks of water, and keep them there for several days, so that the hull may come off more easily.' Coffee obtained by the first method is known as *thick hull*, or *sun dried*, by the two latter processes *washed* or pulpless coffee. In some of the provinces the planters use dryers, but this is rendered unnecessary, owing to the splendid facilities afforded for drying by the natural rays of the sun, a method more advantageous to the coffee than the dryers. By means of cylindrical or disc hullers, the former being the best machine, farmers can hull by hand ten arrobas (320 lbs.), and when using steam or water, 800 lbs. per day. American machinery, of improved pattern and design, is used by the better class of growers for hulling, screening, selecting, and polishing coffee. These machines have a capacity ranging from 250 arrobas in ten hours to 400 to 500 arrobas in twelve hours. Brazil coffees vary greatly in form, colour, and flavour, and are exported, when ready for market, from one of four ports—Rio de Janeiro, Santos, Bahia, Ceara. The provinces of Mines Geraes, Capitaina, and the northern portion of S. Paulo send their product to Rio, at which place they are classed either as high land or bottom land coffee, and branded as follows :—Superior, Primeria boa (good firsts), Primeria regular (ordinary firsts), Primeria ordinaria (low firsts), Segunda boa (good seconds), Segunda ordinaria (low seconds). Santos coffee goes principally to Europe. It has a less rank flavour than Rio coffee, and much of it has the appearance of coffee grown in other countries. Bahia coffee, owing to its mode of preparation, does not rank as first quality ; it is branded either S, SS, SSS."

Taking the figures of the *American Grocer* as approximately correct, and converting them by a comparatively small addition into round numbers, we get a consumption of coffee in non-coffee-growing countries of 1,000 millions of pounds of coffee. The distinction we have made is highly necessary, because the estimate of the Brazilian authorities themselves is, that for an average of 200,000 tons exported an average of 60,000 tons per annum of the coffee grown in Brazil is retained for home consumption. The equivalent in pounds of 60,000 tons is 134,400,000 lbs. and we suppose we may add an equivalent amount for the consumption of other coffee producing countries, Java, Ceylon India, &c.? We then get

	Tons
Coffee consumed in non-producing countries, ...	1,000,000,000
do producing countries	268,000,000
Total for the production and consumption of the world	1,268,000,000
or in round numbers	1,300,000,000

figures which must be pretty near the mark, for, a good many years ago now, the best materials within our reach led us to believe, that the coffee production of the world was not much under 13,000,000 cwts. Since then Java, Ceylon and India have gone back rather than increased. We are willing to look on 1,200,000,000 lbs. the equivalent of 600,000 tons, as near the mark for production, of which about one-sixth is consumed where grown and five-sixths sent into the markets of non-coffee growing countries. The United States take considerably over one-sixth out of the five-sixths available, leaving 34,000 tons less than 400,000 tons for Europe, the Cape, &c. Except in the case of Brazil, production has decreased rather than increased, while the taste for coffee has widely spread and is still spreading ; especially for such superior plantation kinds as Ceylon is famous for, and which would be taken if the quantity were doubled. Of course we cannot say what amount of coffee Brazil may export in the season which has just commenced, but as to future years we have no reason to doubt the correctness of the information we gave our readers some time ago to the effect that a large proportion of the plantations which send their produce to Rio have deteriorated, quite in proportion to the advance made in the San Paulo districts ; so that anything much beyond her average of 200,000 tons Brazil is not likely we believe to send into the markets of the world. There is any extent of fertile soil over a wide range of more or less suitable climate, but the labour difficulty is likely each year to increase instead of diminishing. Ceylon planters, therefore, need not fear the swamping of the market as the result of any facilities to combat leaf disease and increase yield which railway extension may give them. It is rumoured that information supplied to the Railway Commission represents the averages of such districts as Dekoya and Dimbula as only 5 and 4 cwts. per acre respectively. Rates of production which would have led and did lead to the abandonment of estates in the era of low prices pay fairly now, because of high prices. It is scarcely possible to exaggerate the evil effects of the leaf fungus in lessening yield by enfeebling the trees. Had leaf disease never appeared, or had railway facilities been simultaneously available, we believe that 8 cwts. per acre instead of 4 would be the average yield of mature coffee in Dimbula. But small averages, such as are, unfortunately, the rule, are the strongest possible arguments, not for hesitation about railway extension, but for urging the greatest speed in providing what is simply indispensable, if Ceylon is to hold her position.—*Ceylon Observer*.

SERICULTURE.

INTELLIGENCE received from Resht announces that the silk crop in those parts is likely to be a failure this year. The greatest part of the silkworm eggs imported from Khorasan have turned out to be spurious, and microscopic observation had foretold the worthless nature of those produced in Ghilan. The crop is expected to be much worse than even last year's crop—and that was the smallest crop ever known in Ghilan.

WHAT is likely to be a very valuable discovery has lately been made with regard to the silkworm, which if it can be put into as practicable application as it seems to promise, may create a very considerable change in the production of silk. It is supposed that it is possible to obtain in the year two yields of the raw material in place of one as at present. The moth lays its eggs in May or June, and they remain in a dormant state until the spring of the following year. Sometimes, moreover, the eggs are observed to hatch spontaneously ten or twelve days after they are laid. That circumstance having come to the knowledge of M. Duclaux, Professor of the Faculty of Sciences at Lyons, he commenced a series of experiments, and has dicovered that the new hatching or forcing can be procured at will. The means are very simple. The eggs are to be rubbed with a hard brush subjecting them to the action of electricity, or a more sure way still is to dip them for half a minute in concentrated sulphuric acid. Another experimenter states that he has found the same effect produced by chlohydric, nitric, or even acetic and tartaric acids. The operation must be performed while the eggs are young—the second or third day at the outside. Moreover, the eggs from the second batch thus obtained are said to produce the following year a much more hardy progeny.

SERICULTURE can hardly be said to be established as an industry in New South Wales at present, but the experiments that have been made in this direction afford abundant proof that the colony is admirably adapted for the growth of silk. Several varieties of the silkworm, including the Italian, French, and the Egyptian, have been introduced there with marked success, and they have hitherto been entirely free from any of the diseases that have proved so fatal to the worm, and so destructive to the industry in many parts of Europe. The food they require can be produced in any quantity and in great variety, as there are several kinds of mulberry growing in the colony in great luxuriance. Several individuals have devoted considerable attention to the rearing of the silkworm in the colony, and they have been so far successful that they have shown that silk of an excellent quality can be produced, and with comparatively little trouble or expense. The peculiar qualities of the silk produced are that it is more than ordinarily strong in the fibre, and it is possessed of unusual lustre. Some few years ago a gentleman residing in Maitland, on the Hunter River, amused himself with rearing a small tray of silkworms. He carefully saved the cocoons and wound off the silk, a skein of which he sent home to friends in England. This silk was shown to one of the largest silk merchants in London, who immediately made an offer, to take any quantity of that description of silk, at the highest price then being given for the finest qualities in the London market. Mrs. Bladen Neil and Mr. Charles Brady, are the largest silk producers in the colony at present. Mr. Brady, who has given much attention and study to this industry, has discovered a method of regulating the hybernation of the grain, or silkworm's eggs, so that the hatching can be protracted or kept back as long as may be desired. In this way one of the greatest difficulties in the way of successfully rearing the worms is avoided—that of having the eggs hatched before the food is ready for the young worm. By Mr. Brady's process the eggs can be hatched in such quantities and at such times as may be desired, so that the rearing of the worms is reduced almost to a matter of certainty and absolute calculation thereby securing the utmost economy in the working of the industry.

CINCHONA.

THOSE who are now engaged in this cultivation are exercised as to future stores of moss. The growth of moss is slow, and reproduction cannot be expected to keep pace with enormous demands on the natural sholas for this article. A gentleman interested in cinchona informs us that a successful substitute has been found in the ordinary thatching grass, which is plentiful in the estates of Wynaad. To prevent insects getting access to the grass, it is necessary to leave six inches or so of the trunk at the bottom uncovered. The thatching grass so far answered all the purpose of moss, and is a great deal cheaper. We shall be glad to hear the experience of other planters who have tried thatching grass. If generally adopted the seignorage which the Government proposes to levy on the collection of moss is not likely to add much to the revenues from forest produce on the Neilgherries.

In our issue of the 7th instant (says the *Madras Times*) a correspondent referring to the article on the Cinchona Commission which appeared in the *Planters Chronicle* of the 6th, enquires why the writer considers it ' too premature for the Government to abandon their plantations to private enterprise." The reason, we think, should be obvious enough. Cinchona culture on the Neilgherries has by no means attracted much private enterprise. We have no statistics before us, but we are perfectly well aware that the number of cinchona estates owned by private gentlemen, or companies, on the hills, is very small indeed. Some eight years ago a few plantations in Neddivutum, belonging either to Government or the late Mr. MacIvor were sold, and the purchasers rooted out the cinchona and planted tea and coffee instead. When private enterprise appears to be so indifferent about cinchona culture, surely it would be premature for Government to give up their large plantations and laboratory to private individuals. For our own part we should be glad to see private enterprise enter the field. But is there any large capitalist or company willing to take up the Government plantations?

We believe that Captain Campbell Walker proceeds to Coimbatore to undertake Forest settlement and demarcation work in the Southern Division of that District. Our announcement of his appointment as Superintendent of the Government plantations *pro tem.* was, we find, premature. The labors of the Cinchona Committee, consisting of Mr. Barlow and Doctors Cornish Bidie and King, have not yet terminated. The Government resolve to consider Captain Walker's Report on the history and future management of the plantations simultaneously with the proposals of the Committee now sitting on the question of the local manufacture of the febrifuge and the re-appointment of a quinologist. Should the Government decide upon appointing a Superintendent, Captain Campbell Walker's claims will be considered. He is a candidate for the office, and does not forfeit his claims by proceeding on special duty to Coimbatore. No fitter officer, we think, can be selected for the post of Superintendent than this gentleman, and his numerous friends in Ootacamund will be glad to welcome him back again as head of the Cinchona Department. That the Government Plantations require a professional officer, there is no room to doubt. The experiment of working this valuable property through the Commissioner cannot be considered even a moderate success, notwithstanding the satisfactory financial results produced during the last few or two years.—*South of India Observer.*

About a dozen years ago the then Secretary of State for India, in a letter to the Madras Government, stated that it would be advisable to put forth every available effort to promote the cultivation of the cinchona tree throughout India, chiefly in those districts where the curative properties of this exotic would be of special benefit. What are called the "malarious districts" were referred to as places to which the cultivation of this tree should be extended. Some stress was laid on the point that whatever Government may do in this direction should ultimately be made to lead to native agricultural industry being interested and engaged in cinchona planting. Government have, with more or less judicious liberality, expended a large sum of money in getting up cinchona plantations in Ooty and its neighbourhood. Whatever difference of opinion may exist as to the methods employed for making these plantations successful experiments, it must be admitted that under the hands of the late Mr. MacIvor they have, to a great extent, realised the hope and expectations of the authorities. It is not our intention, and indeed it would be utterly superfluous, to reiterate the history of this experiment under the entire direction and support of the Government. But, hitherto, this new development of the resources of the soil of Southern India has attracted but little, if any, attention from the great agricultural class,—great, if not in political influence, or wealth, yet from their numbers. Mr. Elliott of Mysore, who in the discussion of such questions as the planting industry of Southern India, is the leading mind of the East Indian Association in London, in one of his speeches at a meeting of that body, proposed that the Government should interpose its authority to compel the ryots to set apart a portion of their holdings to plant cinchona trees in districts where there is some hope of its thriving. But Mr. Elliott's proposal is hardly one that the Government would be induced to recognise as wise or practicable.

The fact is that in this and kindred matters bearing upon the subject of agricultural improvements in India, the obstacles to be tided over are great, owing to the fact that the most conservative section of a people who, like all Eastern races, adhere to and worship *mammool*, every innovation that in some way breaks with their past is looked upon with suspicion and distrust. Despite the Model Farms the ryot's mind does not, and perhaps for many years to come will not, recognise and appreciate the fact that there is immense room for improvement on the modes of cultivation which custom has consecrated and made familiar. But even the dull bucolic mind is not impervious to ideas associated with some profit pecuniary or otherwise. If it can be firmly impressed upon the ryot that the cinchona tree, if grown in a part of his holdings, would be of real advantage to him, the cultivation of the tree might be extended under other than direct Government auspices. But even this is a difficult task; the agricultural school-master, so to speak, may be abroad in the persons of two or three scientific agriculturists, like the gentlemen who superintend Government Farms and Botanical Gardens. But they are few in number, and it must be up-hill and almost hopeless work for these pioneers of reform in an important direction to overcome the dead mass of ignorance against which they have to contend. It strikes us that the Forest Department might be made to help in extending the cultivation of the plant. There must be some parts of the country where this Department is in active work when the ground cleared of forest is well adapted for the growth of the cinchona tree. The substitution of the cinchona for the wild growth of an Indian jungle would be an advantage in more than one way. The Forest Officers, in the course of their duties, come in close contact with the cultivators of the soil, and they possess abundant opportunities of dispelling, by precept and example, those conservative notions and prejudices which make the ryot class look askance at anything that is in any way not in keeping with old traditions and old customs. In this way, the wish expressed years ago by the Secretary of State would have a chance of being realised.

IN CEYLON.

(*From the Ceylon Observer.*)

It seems pretty well settled in regard to *C. officinalis* and *C. calisaya* that the smaller the leaf the better the bark. But it is to be noted that plants which have large leaves in the nurseries get small leaves when planted out. We feel satisfied that the best kinds of *calisaya* will yet be established in Ceylon, what with seed from British Sikkim and from Java. Such varying results have been obtained in the Sikkim Gardens, some calisaya trees yielding bark of excellent quality and others bark positively inert, that our good friends Dr. King and Mr. Gammie are very chary of sending out seed. But only a few plants out of many despatched in Wardian cases can be got to grow, and propagations by cuttings is a slow process compared with that from seed beds. Besides which, a large proportion of Ceylon planters have come to the conclusion that plants derived from cuttings are destitute of those tap-roots which give seedlings a so much firmer hold of the soil. Our readers know how sceptical we are as to spontaneous hybridization, and how strongly we believe in numerous varieties or *forms* as Howard prefers to call them in the case of *C. calysaya* and *C. officinalis*, for which we may tell a correspondent who asks for directions how to cultivate *C. condaminea*, *C. condaminea* (named after the French physician de Condamin) is but a form. If he has got seed of *C. condaminea* his plants will be just plants of *C. officinalis* and like them have to be grown from 4,000 feet upwards as far as he can go in Ceylon. We have gone the length in our unprofessional rashness of saying that even cuttings taken from small-leaved varieties of *C. calisaya* and *C. officinalis* will sport away into big-leaf forms. At such heterodoxy in an outsider, Mr. Gammie, the trained botanist and practical gardener, waxes wroth, and he writes to us .—

" You surely don't mean to say that a plant (with *very* few and rare exceptions) is not exactly re-produced when propagated by cuttings? If you take a cutting from a scarlet geranium are you not certain of getting a plant exactly like the parent? And will not a Ribston pippin graft as certainly bear Ribston pippins! and so on with everything. As regards the 84,000 Cuttusinga plants on the Nilgiris, I suspect that they were not all raised from cuttings, but partly from seed borne by the earlier of these cutting-plants, which would quite account for any, amount of diversity, especially if other cinchonas were flowering at the same time within a mile of them. But I have not seen your article and may be mistaking your argument. I don't quite gather whether you mean that there will be diversity in the yield of alkaloid only in cutting raised plants of angustifolia, or that there will also be diversity in general appearance.

"If you mean the former only, I can't contradict you with any certainty but if the latter, you are most certainly in error. You will yet be convinced that we are doing you a good turn in keeping bad calisaya seed from you. Our experience and that of the Nilgiris put the fact of the worthlessness of the majority of hybrids—varieties, if you will—quite beyond the doubting stage. I shall be much surprised and disappointed if our calisaya seed do not turn out a better class of plant than the Java seed. May experience of the Java seed is very unsatisfactory indeed.

" I am sorry to hear of the loss of so many officinalis plants in Ceylon. Cinchonas behave—in some respects—much the same everywhere, and I imagine the universal experience points to cropping the moment the plants show signs of deteriorating.

" We collected over 340,000 lbs. of dry bark last season. On a rough calculation 1¼ million lb. of dry bark have been harvested in this district to date. About two-thirds from the Government plantations and the balance from private gardens.

" Red-spider has done a good deal of damage to several tea gardens here this season. Both old and young gardens are affected. Between it and the low prices, tea prospects are not very bright."

As cinchona plants, even when derived from cuttings, sport off into various forms of vegetation, we have quoted the distinct statement made by Broughton to Howard, that he had seen a particular branch of a large-leaved *C. officinalis* presenting in its leafage all the characteristics of *C. angustifolia*. No doubt the chances of perpetuating valuable species are immensely greater in the case of cuttings, but, looking to the slowness of the process and the other possible objection of deficient tap-root, we say give us the seed of the best kinds, and, if different forms of variable value are produced, just let them grow together, until the harvest or until a man like Mr. Gammie comes to help us to weed out the undoubtedly bad ones—if in the climate of Ceylon any can be bad. But, though we are quite willing to risk our own prospects on plants of *C. calysaya* as well as *C. officinalis* derived from seed—sceptical of hybridization and believing in forms merely of good, better, best (in our climate), yet we beg our readers to note that they must well weigh against the opinion of a layman who is neither gardener nor botanist but only a careful observer, the dicta of men honoured in the world of science for their knowledge of botany and skilful from a Kew training and wide experience as gardeners.

We ought to learn much from the report of Captain Campbell Walker on the Nilgiri plantations ; on the mossing process, &c., which one of the Madras papers announces has been sent in to Government and read in Council. As to the number of trees we are prepared to hear that there are fewer than were reckoned on. This is generally the case with plantations. But we shall be much mistaken if the mossing and renewing processes are not pronounced a great success. We can but speak of what we saw and heard. But here, also, our unscientific opinion has to be weighed for what it is worth when put in opposition to that of a gentleman so eminent in the walks of science as Dr. Bidie. He believes that when the bark is off, the tree must die , but we saw and took away with us proofs of the wonderful recuperative powers of the trees, aided by damp moss applied immediately after decortication (not decoration, as a Madras journal made it in re-printed an article of ours). Poor McIvor went to his grave with the conviction that, instead of being honoured for one of the grandest discoveries ever made in horticulture, he was persecuted by doctors who knew about the qualities of drugs better than how to cultivate them. Drs. Bidie and King are now sitting as a committee at Ootacamund to consider the questions of the value of the febrifuge, and of reviving the post of Quinologist on the Nilgiris. Howard and the other manufacturers at home do not believe in such local efforts, but we shall hear all about this and other matters when the report is published. One report gives Dr Bidie a post in connection with the cinchona plantations , another represents Captain Campbell Walker as being appointed Provisional Superintendent. Whatever arrangement is made, we hope the system will be continued of giving the world the benefit of the information obtained in connection with the Government gardens and experiments in culture, manufacture, &c. Another planter in Ceylon, who hails from Dikoya, we may say, has been in correspondence with Dr. King, and has obtained information, a good deal the counterpart of that conveyed to us. Here are extracts he has kindly sent.

(Extract from letter of Dr. King regarding samples of the Annfield cinchona bark.)

" I sent your samples just as received to Mr. Wood, our quinologist, for analysis, and I enclose his report. Will you send larger samples—at least 4 oz. of each sort—and he will give a fuller account. Calisaya with us in Sikkim *sports* dreadfully. Seed taken from one tree produces about 10 or 12 varieties, some of which have splendid bark, while others have bark that is nearly worthless, so I have given up propagation of calisaya from seed. I now only grow the three best kinds from cuttings. As the cuttings are very hard to strike, it is slow, up-hill work. The bark market fluctuates very greatly and is now low. Our crop last year was 320,000 lbs. of dry bark, but we never sell any bark. It is all made into febrifuge for Government hospitals, and what febrifuge is not wanted by Government is sold to the public. The Bengal Government don't want to interfere with private enterprise by selling bark. The Madras Government, on the other hand, sells all its bark. The febrifuge is capital stuff, stronger than quinine and a perfectly efficient substitute. I can hardly meet the demand for it.

" I have no reason for thinking that your seed from cinchona trees five or six years old is not as good as seed from trees 17 years old. So long as the plant is healthy its age does not matter much."

[And we would add, quite agreeing with Dr. King, provided the seed be quite ripe when gathered.—Ed. *C. O.*]

" June 27th, 1878.

"My dear King,—I told you in my last that I could make nothing of the sample of calisaya you sent me because the quantity is so small. I have tried to analyse the officinalis, however, or what appeared to be the officinalis, for the samples were both in one envelope and had got broken and mixed somewhat. The calisaya still had its string round it ; what was loose I took to be officinalis. There were 168 grains of it.

"It yielded 2·8 per cent. of total alkaloid, consisting chiefly of quinine, that formed a good crystalline sulphate. I am sorry the quantity was so small that I could not estimate the latter correctly. I should guess however, that the bark would yield 2 per cent. of cryst. sulph. quinine.

" If you like to get me larger samples I shall be very happy to make a more thorough analysis. But we ought to have at least 4 oz. of each for the purpose. It would be interesting to know what the calisaya contains and whether it is as good or better than our own."

Nothing can be founded on this imperfect experiment, except confirmation of the fact that bark of *C. officinalis* grown in Ceylon is specially rich in quinine, the most valuable of the alkaloids.

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THE INDIAN AGRICULTURIST.

A MONTHLY

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NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb. 1876.

R. KNIGHT.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

NITRIFICATION UTILISED.

SIR,—I have read with much interest an article on "Nitrification utilised" in your last number of the *Agriculturist*, but should like to know whether the ammonia in the manure would be dissipated by the presence of carbonate of lime or not. My idea was that it would: but is carbonate of lime at all necessary in the process of nitrification?

May I ask the difference between leached and unleached ashes?

ENQUIRER.

NOTE.—Leached ashes are wood ashes that have been used for the manufacture of potash lyes for soap manufactories by percolating them with water. They contain little or no soluble alkalies but more lime than unleached ashes.—ED., *I. A.*

BLASTING TREE STUMPS.

SIR,—The old method of blasting tree stumps used by A FORESTER, and described in your paper of the 2nd September, would answer well enough, and be the best perhaps that could be adopted where the number of stumps to be blasted is not large. But where a good number of stumps have to be disposed of it would be found more rapid and certain (besides requiring less powder) to tamp the hole with an iron plug about six inches long having a screw cut on it and tapering for about the last two inches of its length, to admit of its easy insertion into the hole. The threads of the screw are cut deeper and are sharper than the ordinary Whitworth thread, and a small hole is drilled through the centre of the plug, longitudinally, for the fuse to be passed through after the plug is screwed home. The top of the plug is made square in section to receive a key, with arms about 1 or 1½ foot long, to turn it. The method of using this is obvious.

I have used this method of tamping holes in blasting tree stumps for many years and have found it a great saving of time; besides clay fit for tamping is not to be found in every place.

ENGINEER.

N.-W. P., September, 18th, 1878.

DE OMNIBUS.

LONG STEMMED RICE.—In its wild condition the rice plant is a long stalked aquatic, growing in water sufficiently deep to drown a man. This indigenous grain is much liked by the fishermen and other dwellers in the swamps and is usually reaped from a boat; vernacular name *Tinni.* Much of it is to be found in the Goruckpore district, and I think in Lower Bengal. Unless watched, it is quickly devoured by flocks of wild fowl. The "deep water rice" of the cultivator is a staple crop in Assam, where it is called *ao dhan* I think it is planted when the swamps are low.

CACTI AS LIGHTNING-CONDUCTORS.—I believe the efficacy of this plant to be only a vulgar superstition. Let any one see "lateral discharge" during a thunder-storm, *i. e.* a serpentine stream of electricty running along the ground and entering doors, and windows, and they will learn the utility of "roof-conductors." In Southern Africa, and Mozambique this dangerous form, and "globular lightning," still more dangerous, are of constant occurrence, causing frequent loss of life and property.

APPLES AS FAMINE FOOD.—This choice European fruit requires too much high cultivation to be suitable food for the million. Better to encourage the native fruits—*zizyphus jujuba, ficus* species, *guava* and a host of other wholesome indigenous products. Any one who has travelled in the districts of Cashmere must have observed the abundance and degeneracy of the apple—the produce small, tough, sour and indigestible ; in fact, fast running back to the old primitive *crab.* A well-cultivated apple tree is not allowed to bear much fruit and needs perpetual care, for diseases abound among the *malus* tribes. Why not fringe our railway embankments with *zizyphus* or *guava*, either of which only require rain to keep them healthy ?

THE YELLOW MOLE.—I believe the little quadruped mentioned as suddenly appearing in Roumania to be identical with the *chrysocoma* of South Africa, the greatest pest to fields and gardens, as it will not enter a trap. To catch one is uncommonly difficult—a charge of shot administered when he is working at the surface is the only mode of destruction. All my carrots, potatoes and other root-crops suffered terribly and worst of all my terraces and water-courses were " tunnelled" and sapped. He is properly a Shrew (*sorex*) and not a Talpa (or *mole*).

THE GIANT BAMBOO.—Those who would see this glorious vegetation in perfection must go to Indo-Chinese localities, amid the virgin soil and abundantly watered forests of the Upper Brahmapootra (towards the *Booree Dehing* and *Bor Kampti* country,) and where milk-buckets (bound with brass) and water-jars, irrigation pipes and quivers are made from its huge cylinders. Even cannon were by the Burmese, fashioned out of a stout bamboo cylinder, bound with raw-hide ! The *Kamptis* make a pleasant acid pickle from the fresh tubers, blanched and fermented. I have made travelling cases 7 or 8 feet long of the same material, under savage superintendence. A sharp chisel blade is mounted at the end of a strong stick, and with this simple tool we used to dig out the interior joints—so with the water pipes of any desired length. One of such cases held all my fishing rods. The short wide cylinders were also a ready receptacle for any new plant, or living reptile found during the journey. I carried rum for my native allies, ghee, oil, &c., in the same way with the great advantage of *no breakage.* A bamboo cylinder is the favourite tea chest of all the tribes. After being gathered and crudely manipulated, the leaf is mixed with a little salt, and rammed tight into this queer box, the mouth of which has a stopper ; when a supply is wanted, the stuff is extracted with the pointof a knife, looking much like Cavendish tobacco ! The banks of streams which do not overflow seem to be its favourite habitat.

BLASTING TREE STUMPS.—Gun cotton and dynamite do the work most effectively, but as they are unprocurable in India, I shall not speak of them. The two following simple methods I got from the American *Agriculturist*, many years ago.

No 1. Bore down into the stump ; and pour into the holes petroleum, or dissolved saltpetre, leave them to absorb the liquid or oil ; then light a small fire over the aperture, the stump will then burn like tinder.

No. 2. Bore a hole *from* top to bottom of the stump with a two inch auger, then in the side of the stump near the ground bore a horizontal hole to meet the first, this will give a draught of air to nourish the fire which is lighted on the stump in a small heap of dried sticks. Stumps so treated have been frequently known to be consumed far into the roots.

No. 3. requires a small metal apparatus not easy to describe without a diagram, it acts by splitting up the wood after an explosion ; this is also used in Illinois for parting heavy logs to make fence posts, the swamp oaks being knotty and refractory to the workmen's tools. A steel screw of three inches long, tapering so as to fill an inch and a quarter hole, is made with a small hole through its centre to admit of a fuse, an inch at top is left square so as to fit a strong key (like a screw-tap or wrench). Bore to the centre of your stump or log with a one-and-a-half-inch auger, put your charge of gunpowder in the hole, screw in steel plug, pass fuse to connect with powder, make a square hole in a very heavy log with a small hole for the projecting fuse, fit this on to the metal screw top, or range fuse in small hole,—then fire it.

ROSE CULTURE.—In reply to your Peshawur correspondent "Baghban," I beg to state that he will find in "Hole's Book of Roses, and their "[illegible]" (for sale in Calcutta, and recently advertised in the newspapers), the *best* of all the many books on this subject. The South of Europe is a perfect Rose Garden, and I think Peshawur ought not to be much inferior as regards climate and ~~seasons~~. Hole appears to be one of our most successful rose growers, and is very full in his descriptions. With Cashmere so close at hand, its charming *double-flowered briars* should be introduced and budded on the single yellow species (common in the vicinity of the above station) then hybridized, and gradually brought down to the most favourable localities, for its acclimatization, as Dehra Dhoon, &c. I grew the single-flowered yellow briar by "budding"—even at the hot and arid station of Ferozepore, some 30 years ago, and made it flower there, with a certain amount of care and attention.

ON INDIAN NETTLES.—In the virgin Forests of Upper Assam (a few miles North of Suddyah), is the natural habitat of a tree-nettle, 10 or 12 feet high, with a stem as thick as a man's arm ; this possesses a wonderful fibre, but is so venomous by reason of its bristly stings, and crowded poison glands, that every human being and even quadrupeds and birds avoid the vicinity. *Urtica Gigantea* is shunned by every living creature, and its ill fame is in the mouth of every savage. I have known a "clearing" deserted, when a strong north wind carried the poisonous hairs before it, producing inflamed eyes and sore throat with catarrh, and dreadful pains in the face. It is a dreadful thing to be benighted in those tracts. Relying solely on the inborn sagacity of our elephants as we crashed through the ancient trees, our noble beasts have come suddenly to a halt. *Nettles* ! *Nettles* ! was the cry and we have changed our course ; had we been afoot, we should have walked into a wilderness of poison and perhaps have perished of innumerable stings. A rapid fever is often the sequel of such adventures, attended by excruciating pain for which no antidote has yet been discovered. Probably, the element of fire is the only safe auxiliary with which these wonderful indigenous plantations of *Urtica* could be encountered, the fibre is superior to the *Bun Rhea* (or wild Bœhemeria) in its size and strength. Possibly a mode of disarming the vegetable tyrant by arrtificial culture may be discovered, but as yet it is not far behind the 'demon nettle" of Timor (*Daoon Satan*) in noxious growth and properties.

W. H. L.

WELL-SINKING IN THE POONA DISTRICTS.

THE WINDMILL PNEUMATIC PUMP.

SIR,—I have been greatly struck this year with the large amount of unsuccessful well-sinking I have seen in the Poona districts. My attention has been more called to this in consequence of the crying necessity for water all over the country. Last year in distressed districts I also observed many wells partially sunk and discontinued. In every case it appeared to me that the reason of abandonment was not the want of water, but the great depth at which it was to be found. As good black soil often lies close to a *nullah* and runs back from it at a considerable slope, the well must be high up, to bring any large portion of the land under irrigation, and must be deep. In fact, the well-sinker will probably have to go down to the level of the *nullah.* Some of these deserted wells are in positions which would have been simply invaluable had the owners been able to complete them. As much as Rs. 150 to Rs. 200 had probably been thrown away on excavating and blasting these pits, and though water was in some cases reached, cash failed.

Again, even with the ultimate certainty of water, if it lies at a great depth, the peasant will rarely go on till he reaches it ; not only because of the great expense of excavating and lining the well, but because of the heart-breaking work for his bullocks in hauling that wretched, leather bag of water from a great depth. Both these pleas have been put forward to me by the peasants as reasons for discontinuing excavation, they considering it better to throw away the money spent than to complete the work. I am much inclined to agree with them, and doubt greatly whether a well of the ordinary capacity worked by bullock power and the leather bag arrangement would give a paying percentage on the outlay if the depth to the water were very great. In the Baramati district which suffered from famine last year, and where there is a large are a of splendid black soil, the depth of the soil itself is too great for remunerative well-sinking ; at least so the peasants informed me, and I believe this to be quite true. My object in writing this letter is to point out that the objections to well-sinking are due to expense in construction and want of power to raise the water in paying quantities, besides increased cost of haulage. Both these are mere matters of capital and mechanical appliances, and there are possibly plenty of people who can supply both. It is scarcely possible for skilled labour and machinery to compete with bullock power where the water is easily reached and the supply sufficient, but where water lies at a great depth and bullock power is useless, I think that there is a great opening for the employment of capital.

I can merely give a sketch of what I consider would be a suitable system for water-supply from deep strata, and one which I think would be certain to pay under good management, either Government or private. I would sink large and deep wells in central positions on such ground as is too deep to pay for ordinary wells. The wells should be deep enough to reach the best water-bearing stratum and to afford a constant supply. The fault of many native wells is that they only *enter* the water-stratum and do not go deep enough to tap it thoroughly. The water should be raised by machinery, and the constant winds in the Deccan would be specially favourable to the Windmill Pneumatic Pump. The only objection to wind power is that it must either have a storage reservoir or be supplemented by bullocks. I am not acquainted with the pump above mentioned, but I understand that it is a force pump, in which case, I presume, the depth of the well is no obstacle, and merely necessitates more power, want of which is the difficulty to the peasant.

A large well with good raising power, should be able to supply a very large area with water for irrigation, and the water would most certainly sell at a high rate. In good pieces of land limited in area, and in a poor country, where irrigation from rivers is impossible or uncertain, I have no doubt that the water would be rapidly taken up.

In districts like that of Kopargaon in Ahmednuggur, where there are large tracts of black soil and comparatively few wells, and where there is much clay demanding an excess of moisture to produce crops, water would be invaluable. To be a success, however, the wells must be under European management, and there must be a competent mechanic in working charge. The supply must be absolutely beyond all possibility of failure. It is essential that the peasant should not be exposed to any interruption in the flow of water to irrigated crops.

It would pay, I think, to work one such well in a good district at a loss, or at any rate on speculation for one year, merely to show the people that they can get a constant supply. I can confidently assert that the water would be taken up more readily than canal water, which the people say is too *cold* and requires more manure than well water; not that I ever heard them say so of their own village canals, though they always do when Government supplies the water. Once a well of this sort shall have proved successful, it would probably be possible to arrange for others among the peasants themselves.

In the first instance the site of the well and some land round it would have to be bought out and out, and a small portion of land cultivated by the promoters as a sample, but afterwards cultivators could probably be induced to give the site free, or lease it for a term, and agree to take a certain amount of the water. A number of wells in the same district could thus be under the same management, which would greatly decrease the cost. I refrain from giving any estimates of probable outlay or returns, though I have considered the matter. Nothing is so misleading as insufficiently based calculations, and I have no accurate knowledge of what a large well would cost, though I know the cost of the average irrigation well. The country in which such an enterprise would succeed is where the soil is good and deep but the rainfall scanty, and there are many such in the Deccan.

The question is large, and can scarcely be treated fully in a letter of this sort. I may add that simple cane-crushing machinery worked by wind or bullock power attached to the well would probably pay largely, saving both time and bullock labour. Both these machines, the pump and the cane-crusher, would also set free bullocks for cultivation, which would otherwise be employed in raising water, all the year round, were the crop is sugarcane.

It would probably pay Government well to take up a scheme of this sort where canal irrigation is impracticable or too expensive. Canals are, I think, beyond question the most valuable works in the country, but much land cannot be watered by them, and many isolated bits of good land exist where no canal can come. There is, however, a good opening for private enterprise in a scheme of this sort, and I have long thought of suggesting it. Public opinion is, however, so much against an official writing in newspapers on any subject, much less on one not connected with his own department, that I have not thought fit to bring forward these suggestions till the circumstances of the past two years induced me to offer them for consideration.

A. B. FORDE,
Revenue Survey.

Indapore, August 20.

ASPARAGUS.

SIR,—The accompanying paragraph will be useful to amateur gardeners:—

"To lovers of asparagus *Le Cultivateur* draws attention to a method of cultivating this highly-prized vegetable, known as the system Argenteuil. The beds should be dug out, and the earth raised about five. centimetres. The excavated space in them is then filled with tan Asparagus so grown is both more prolific in the number of heads and the size is. greatly increased; another great advantage is that the growth is much more prompt."

ASPERGE.

PRICKLY COMFREY.

SIR,—If any of your readers have tried this fodder plant, and found it a success, would they favor the many interested in such matters, by reporting on the success? Two seasons ago I was at considerable expense in getting from a London firm the best "solid stem variety," and believing somewhat in the dictum of the *Times of India*, "Prickly Comfrey should be planted over the length and breadth of India," I tried it largely. Its sole value, and "reason for its being" here, was, that in the dry season it was to afford good—if not abundant—pasture; in the monsoon it did—and does—beautifully; but in the dry season its leaves shrivel up, and many roots die out altogether; this tried on well-tilled and manured land—on entire new ground with rich soil—on hill sides—and on places where it was now and then irrigated. Last year I advertised root cuttings for sale; now, I will be glad to give sets of roots to any who wish to try it, and will send or them.

A. HAY ANDERSON.

Geulee Estate;
Manantoddy, August, 1878.

WEEDS ON COFFEE ESTATES.

(To the Editor of the Madras Mail),

SIR,—A great deal has been said and written on the subject of weeds on a coffee plantation, but much misapprehension appears to exist regarding the part that weeds play in the economy of nature. Many planters rail against them as the "bane of coffee estates," and think that the highest praise that can be given to a planter is that his estate is "clean." When, however, the matter is fairly considered, it would seem that weeds are by no means the unmixed evil that they are often represented. The notion that perfectly clean land is best for coffee, would appear to have been derived, by those who have imperfectly studied the matter, from the practice of agriculturists, who alway endeavour, and with reason, to keep their land free from any growth except that of the particular crops which they are raising. Agriculture and arboriculture are, however, two very different things.

The farmer about to lay down a field in wheat, for instance, knows very well that if he has weeds growing amongst it, that part of the nourishment which should go into his wheat, will in fact, go into the weeds, and that by that amount he is a loser. His wheat and his weeds grow, and are cut together; his wheat is profit, and his weeds are loss. On a coffee plantation things are very different. The weeds and the coffee grow together, but not as in agriculture are they gathered together, but the crop is picked, while the *tree* remains with the weeds buried round it, forming the best of all manure—pure leaf mould. What, then, is taken from the soil? Simply the coffee crop. All that the weeds took from the soil is returned to the soil, *plus* a large amount of carbon and ammonia, absorbed from the atmosphere. If the lives of the coffee tree and of the weeds were conterminate, as in the case of wheat, all that the weeds took from the soil would be sheer robbery from the coffee. But it is not so; the life of a generation of weeds is but as a span, compared with the life of a coffee tree, and as each generation of weeds is cut down and buried, all which it took from the soil is returned with interest. What is jungle-soil, but rotted weeds! The rich soil of the Neilgherry sholahs did not fall from heaven above, or spring from the rocks beneath, but is simply the accumulation of generations and generations of dead weeds. First a seed found a resting place in a moist corner of the rock, or gravelly soil—it germinated, spread its leaves, and died, forming the first morsel of vegetable mould The next seed wafted thither fared better than the first, in that it had the mould evolved by the decomposition of its predecessor, in which to grow; and so on by degrees, until the mould formed by generations of plants gradually became strong and rich enough to support gigantic trees. All this has resulted from the natural growth and burial of weeds. So far from any exhaustion resulting from this vegetable growth, the very opposite has been the case. The vegetables themselves have formed the soil in which they grow, so it must always be where there is any vegetable growth, and such growth diesand decomposes on the spot on which it grew.

If, on a coffee estate, the weeds were carried off, or otherwise made away with, improverishment of the soil would follow; but so long as they are annually buried, the only result which can follow is an increase in both the bulk and richness of the soil. All that the weeds really deprive the coffee of is the benefit of the constitutents of the soil which go to form a single generation of weeds! This is a trifle, and if soil is so poor that it cannot grow coffee, and also, during a few months of rainy weather, support a single generation of weeds in addition, it must be "poor indeed," in fact too poor to be planted—by a wise man—with coffee. That an estate could be profitably worked which was covered with weeds all the year round, is of course impossible, but so long as weeds are only allowed to grow during the rains, and are then dug into the soil, they do no harm, but a great deal of good by keeping the soil from being washed away. Weeds undoubtedly do harm in the dry weather, as the moisture in the soil is then limited. and it is insufficient for weeds and coffee; but in the monsoon, the moisture is far in excess of what is required. In young coffee, also, the soil should be kept perfectly clean, so as to allow the young and delicate coffee roots to spread and strengthen without interference, and also in order that the young plant may be exposed in all its parts to the action of the sun and air, and that the whole moisture in the ground may be available for its growth alone. The young coffee plant needs in fact the care which any young thing needs, vegetable or animal, and which is entirely different in its nature from the treatment required in its maturity. The advantages of weeds, then, consist in their preventing loss of soil by wash, during their lives, and by continually enriching the soil in their deaths. To set against these is the single disadvantage, that during their brief lives, a certain small proportion of the constituents of the soil are locked up in them for short intervals.

PLANTER.

Neilgherries, August, 23.

Sir,—"Planter" begins by saying that "much missapprehension seems to exist regarding the part that weeds play in the economy of nature," and goes on to remark that "the notion that perfectly clean land is best for coffee," must result from the "imperfect study" of the matter. "Planter," from his own arguments, appears to labour under a fallacy quite as great as those who "rail against weeds," and who accordingly have not perfectly studied the loss sustained from weeds. He asked "what is jungle soil but rotten weeds?" Whatever weeds have gone to form the soil of the Neilgherries, I am confident that our soil in Coorg is not composed of the ingredients contained in "Goat weed" "Spanish needle," wild bringal, *et hoc genus omne*. To prove it, let any one interested clear a bit of forest, allow it to grow up in weeds like those just mentioned, leave it in that state for some years, and then come to plant it up; it will be seen whether weeds are not the "unmixed evil that they are often represented to be." Again, "Planter" argues that by burying in the weeds, you "put in all that the weeds took from the soil, *plus* the large amount of carbon and ammonia absorbed from the atmosphere"; but why take anything more out of the soil than is absolutely necessary? And when it is found that "carbon and ammonia" are requisite to maintain the original fertilizing power of the soil, are there not other and more approved means of attaining this end than by allowing weeds to flourish for the purpose? There is an admission on the part of "Planter" that to young plants weeds may prove injurious in interfering with the delicate spreading roots, and by preventing the access of light and air. Now does it not strike the most casual observer that whatever is good for the young plant, must in a similar degree be good for the mature tree; and instead of the young plant requiring more room for nourishment, it is directly the opposite that holds good? An old tree after having produced one or two crops requires, I maintain, more room for its tender rootlets to pursue their cause in quest of food and air, than does the young plant from the nursery. Considering the weakness of his hypothesis "Planter" was making rather a good case out of it, until he came to the part in which the weeds were to play an active part in the prevention of "wash." I know I have very vivid recollections, after a good day's work of burying in weeds, and after a shower of an inch or so, coming back the following day, and there beholding wash, which for magnitude I never saw surpassed.

ANOTHER PLANTER.

Coorg, 3rd Sept.

ERRATA.

Sir,—On looking over two of my late productions, inserted in your journal, I notice the following errors.—

Apricot cultivation, page 229, line 33, right hand column, instead of "pollen," read *koloo* (native mill): at line 40 after the word "bottle" add *of oil.*

While on this subject I may add that about 2¼ seers of dry kernels, yield a quart (beer) bottle of oil; and suggest that a kind of gold-washer's cradle would be useful for the purpose of pulping the shells; and a kind of stamping machine for breaking the shells quickly.

The Valley of the Sutlej, page 296, line 8, right hand column, insert after "*bigah*, and" *4 feet 6 inches every way.*

G. P. P.

HONEY IN INDIA.

Sir,—Can you kindly inform me through the *Agriculturist* where, if anywhere, in India the production of honey is carried on as a domestic industry? And with what general results.

CULTIVATOR.

Astormont, Khandeish Farm,

The Indian Agriculturist.

CALCUTTA, OCTOBER 1, 1878.

LAND DRAINAGE.

We have of late directed particular attention to the treatment of soils, especially with regard to restoring to them the fertilizing properties they have lost by constant tillage, and in our issue of April last we discussed the means by which can be effected, what we may term, the *chemical* improvement of soils, with special regard to tea cultivation. But though manures, judiciously applied, will greatly assist in restoring fertility to exhausted soils, and permit their being constantly tilled with remunerative results, there is one branch of Agricultural Science that has not received, by writers on the subject, so much attention as it deserves,—we mean Land Drainage.

Drainage heads the list of such *physical* improvements as soils are capable of, and deserves quite as much consideration by the planter as any of the chemical improvements of the soil which we have discussed in a former issue. So little attention has been given to this most important method of land improvement by Indian agriculturists, that the most absurd notions on the effects of drainage are still entertained by many of them. Only the other day, when we recommended drainage to an indigo planter who is, in agricultural matters, to a certain extent looked up to by his neighbours, we were told that, in his case, drainage would do more harm than good, as he wanted to keep in his lands all the moisture he could get and could not afford to lose any of it by drainage.

To any one, not knowing the properties of rain and soil, it may perhaps appear doubtful that drainage should benefit vegetation, water being so essential to vegetable life, and to such, the advantage of robbing the soil of its water may appear questionable; but an agriculturist, to whom all the teachings of modern science are accessible, can have no excuse for not knowing that the drainer's object is to remove stagnant water from the soil only in order to give access to more water, and that most soils are drained, *not so much to get water out of the land, as to get it into the land.* More water will pass through a drained, than through an undrained soil; drainage opening thoroughly even the most tenacious soil, giving a free passage to water through it and thus securing to it the entire rainfall, part of which before, on all but sandy soils, found its way over the surface of the land into ditches and *nullahs*, carrying away with it some of the most fertilising elements of the soil. During the greater part of the rainy seasons in India, giving a rainfall of 40 to 120 inches in a few months, clayey and loamy soils are surcharged with water; all parts and pores of the soil are full of it, and any fresh rain falling must find its lowest level, as best it can, *over the surface* of the land, taking with it, if the fall is at all heavy, some of the finest and most fertile particles of the surface soil. When such land is drained, it will under similar circumstances still remain saturated with water, but there being an open drainage below the surface soil, any fresh rain will go *through* the soil, displacing the water it finds the soil saturated with.

It is a very common notion, especially among tea-planters, that rain when it comes down in heavy showers, is injurious and should be carried off the land as soon as possible. They do not consider that rain-water contains most valuable manurial elements, and that the luxuriant vegetation of the tropics is that falls. During the process of condensation, and during its passage through the air, rain absorbs considerable quantities of the constituents of atmospheric air. Rain water is never free from oxygen, nitrogen and carbonic acid, and contains also in varying quantities, compounds of nitrogen, chiefly nitric acid and ammonia. Large quantities of these two latter compounds are found in rain-water falling during a thunderstorm; and from the results of experiments we have made, we incline to the opinion that the nearer we come to the tropics, the larger is the percentage of nitrogen compounds in rain-water. This theory, however, we should like to see strengthened or otherwise, as the case may be, by experiments which could easily be undertaken by the chief observatories in India; our own time not admitting of such extensive experiments as would be necessary to establish the above opinion as a scientific fact.

Rain-water which we gathered in the middle of last month near Mozufferpore, Behar, and examined, we found to contain 2·12 per cent. (volume) of atmospheric air, 100 parts of which contained by volume

Oxygen	32·41 parts.
Nitrogen	65·19 "
Carbonic acid	2·40 "
	100·00

Of other substances, we found in the same rain-water, per one million parts

Nitric acid	23·1 parts.
Ammonia	14·9 "

with distinct traces of chlorine and sulphuric acid. If we now take into consideration that an annual rain-fall of 50 inches, represents per acre a volume of water, weighing 5,064 tons, equal to 1,134,336 gallons, and that according to the above composition, this quantity brings yearly to the soil, per acre, 271 lbs. of nitric acid and 168 lbs. of ammonia, most valuable elements of plant-food, and if in addition to this, we estimate the quantity of carbonic acid and oxygen contained in it, we can then better understand the importance of land drainage and form a crude opinion of the advantages to be derived from the percolation through the soil, of this fluid manure.

The evils of stagnant water are not merely confined to its preventing the ingress into the soil of fertilising showers and atmospheric air, but stagnant water directly injures vegetable growth by lowering the temperature of the soil by surface evaporation, and by confining the roots of plants to the surface; for the roots of the majority of cultivated plants cannot exist in stagnant water, and they either die off or are perverted to the higher strata, thus narrowing the area of food-absorption. In all lands where no natural or artificial sub-drainage exists, the volume of rain-water that falls on them is disposed of, first, by surface drainage, second, by surface evaporation, and third, by absorption by the plants.

We have above referred to the disadvantages of surface drainage, washing away, as it does, the finest and most valuable parts of the soil for the benefit of the deltas of our great rivers. Surface-evaporation means simply an absorption and dissipation of the warmth in the soil, so essential to vegetable life. For every pound of water that evaporates from a field, a certain quantity of heat is abstracted from the soil and dissipated; and it has been estimated that to evaporate 30 inches of rainfall, would require heat equivalent to the burning of 1 cwt. of coal per acre *per hour* throughout the entire year!

While travelling a month back in Eastern Tirhoot, we noticed a practical illustration of this, the rainfall having been in that district unusually continuous and heavy during the latter part of August, and beginning of September. Most lands are very insufficiently drained, some not at all, and in consequence the temperature of the soil was so lowered by the constant evaporation of the stagnant water that the growth of the second cuttings of indigo ("koontees") one of the staple products of Tirhoot, and requiring a good deal of heat for its development—was almost entirely stopped, and such a bad second crop of indigo has not been known in the district for years. Referring to our notes we see that, while the average temperature of the atmosphere was 84° F. the temperature of three of these badly drained indigo fields averaged 75° at a depth of 7 inches, 9 degrees being thus absorbed and dissipated by surface evaporation. On the same day, half an hour after, we took the temperature of two well-drained indigo fields, bearing a good crop of "koontees," situated about 300 yards from the other, and found it to be at the same depth, in one field 86° F., in the other 85°. There was no visible difference in the soil, to account for one field bearing a good, and the other a bad second crop of indigo, so that we considered the good crop a manifest proof of the advantages of good drainage.

Liebig wrote in his "Natural Laws of Husbandry" concerning this subject: "It is well known that stagnant "water in the soil is injurious to most of the cultivated plants; "and the favourable effect upon their growth produced by "draining just depends on this, that an outlet is opened to the "water moving by the force of its own gravity, and the earth "is moistened by that water only which is retained by capillary "attraction. If we regard the porous earth as a system of "capillary tubes, the condition which must render them best "suited for the growth of plants is unquestionably this, that "the narrow capillary spaces should be filled with water, the "wide spaces with air, and that all of them should be accessible "to the atmosphere. In a moist soil of the kind affording free "access to atmospheric air, the absorbent root fibres are in most "intimate contact with the earthy particles; the outer surface "of the root fibres may here be supposed to form the one, the "porous earthy particles the other wall of a capillary vessel, "the connection between them being effected by an exceedingly "thin layer of water." Our space only permits us to point out a few of the benefits gained by drainage, the free access of heat, rain and atmospheric air to every particle of soil having, in addition to the separate advantages pointed out above, a most powerful chemical action upon the mineral plant-food in chemical combination, and rendering, in the same space of time, a greater amount of plant-food available. Drainage reduces therefore, not only the amount of manure necessary to keep up a certain produce per acre, but it will for a few years give increased crops without the use of any manure. On ordinary tillage lands the advantage of a good drainage, has in many cases been estimated at 8 bushels of wheat per acre.

But speaking of Land-Drainage, we must not be understood to mean the shallow surface drains which are now almost universally used in tea and coffee plantations, to carry off any heavy rainfall, as soon as possible, to the nearest river. Nothing could be worse than this; what we mean is, a thorough subsoil drainage, acting three or four feet below the surface, and capable of absorbing into the soil all the rain granted by the bounty of nature, and either consisting of closed pipe, stone, or brushwood drains, or of open drains with good embankment to prevent all surface drainage. Every precaution should be taken to retain in the land all the rain that falls on it, until it has had time to percolate through the soil and impart to it all the manurial elements it contains. In porous, sandy soils, natural drainage, if not intercepted by an impervious clayey subsoil, takes place rapidly, and no artificial measures are necessary to effect this object. If in sandy soils a stiff, clayey substratum intervenes and prevents sub-drainage, a few wells should be dug, until this clayey stratum is pierced and a connection established with a porous stratum at some lower depth. But in stiff, clayey soils or heavy loams, with no porous substratum near the surface to which the water can penetrate, a system of drains suited to the locality should be constructed to ensure the speedy descent of the rain-water and prevent the land being water-logged—a state of things that exists all over the tea-growing districts. Any soil, surcharged with moisture for any length of time, will always injure vegetation existing on it, such injury extending in many cases to the complete dying off of the plant, in other cases confining itself to the encouragement of mildew, rust and other fungoid and parasitic blights. Badly drained tea-gardens, for instance, are never free from all the blights that attack the tea plant, when so to speak, in a weakened state of health, and red spider makes its regular appearance, year after year, reducing the crop often by 30 per cent., and that on gardens which often boast of the finest virgin soil in the district. But the most fertile soil must remain not only inactive but will positively be injurious to perennial plant-life, if surcharged with moisture for three or four months through the year. Every experienced farmer in Europe knows that in a wet summer all his wheat in heavy and badly drained soils will be more or less smutty—and if so in England, with an annual rainfall of only 28 inches, should we be surprised to find blight and disease on badly drained tea and coffee plantations, where we have an annual rainfall of from 80 to 120 inches? The first great and leading principle in practical agriculture is, to obtain the maximum possible yield from any given soil with the least expenditure and without injuring permanently the resources of the soil, and if nature in her bounty, gives us here in India, a high temperature and heavy rains, we neglect our own interests, if we fail to utilise these natural advantages to the utmost extent possible.

We have shewn above what a vast store of fertilising ingredients are contained in rain-water, ingredients acknowledged to be the chief manurial agents known, and considering this, the greatest sceptic must acknowledge that the outlay that may be necessary to secure the thorough percolation through the soil of an annual rainfall of 80 or 120 inches must be more than counterbalanced by the advantage to be derived therefrom. We know of estates that have in the space of four years by the increased yield alone repaid the money expended on draining their heavy lands, which are thus permanently improved.

In heavy soils the drains should be made at short intervals and should be not less than 3 or 4 feet deep, having an incline of not less than one foot per mile. We speak here of open drains, suitable for tea, coffee, cocoa or cinchona plantations. Pipe drains cannot be used for such, as the roots would invariably choke up the pipes, but closed stone or brush wood drains are practicable; the fall in such, however, ought not to be less than 1 in 220. The drains will of course converge to the nearest river, *nullah* or *jheel*; where the plantation lies in a hollow and no outlet can be found for the drains, drainage can be often established by digging a few wells and establishing a connection between the surface and some porous sandy substratum. This plan will also answer where the garden is so surrounded by rice "khets" and villages, as to prevent access for the drains to any *nullah* or river. All drains should, of course, be constructed on the fundamental principle that water runs to the lowest level and a previously well considered plan should underlie all operations. The distance between the drains depends of course greatly upon the character of the soil. When open and easy of penetration, drains 60 to 80 feet apart will suffice, but in case of stiff retentive and clayey soils, they should not be further apart than 30 feet.

It is a very common fallacy entertained by planters that shallow drains, say 15 or 18 inches deep, are as effective as deeper drains. This notion should be got rid of as soon as possible, for it is replete with mischief. Even the effect of drains, 4 feet deep, diminishes steadily and quickly with the distance, especially in heavy soils, the diminishing force being the resistance offered by the soil to the passage of the water. This diminishing force is so great, that at a certain distance it entirely neutralizes the action of the drains and at such distance the soil receives of course no benefit whatsoever from the drains. If such is the case with deep drains, of what use can be shallow drains, 15 or 18 inches deep, generally without embankments? Their only use, as far we can see, is to encourage surface drainage and wash out the most fertile portion of the soil. Some tea gardens have been ruined by these shallow drains. We have a letter before us, written by a most careful and intelligent tea-planter, in which he states that if the superficial drains (about 18 inches deep) which abounded all over his tea garden, had not been deepened to 3 and 4 feet this season, the garden would have been ruined and all the outlay incurred up to date irretrievably lost. The depth of drains must, in every case, lie considerably below the level of the main food-absorbing roots, otherwise drainage will do more harm than good.

The foregoing will, we trust, make it evident to the merest tyro in agriculture, that drainage is as necessary and beneficial for rich fertile lands, as manure is for poor, exhausted soils. We have received many letters on this subject from tea-planters and others who have devoted a great deal of their time to agricultural investigations, and they are unanimous in the opinion that by skilful manipulation of the soil—careful drainage and judicious manuring—not only can the average yield be nearly doubled, but blights, fungoid diseases and animal parasitic life can be completely stamped out.

The drainage of steep or hilly lands, which offers peculiar difficulties, we shall discuss in a future issue.

THE MADRAS AGRICULTURAL COLLEGE.

(By Agricola.)

I NOTICE an extract in your last issue, reprinted from the *Madras Times*, the writer of which must have made good use of his imagination in composing it, for it is full of inaccuracies It refers chiefly to the Agricultural College, founded two years ago, in connection with the Sydapet Experimental Farm, which the writer by the way terms a "Government *Model* Farm," therein falling into the error so common in this country of believing all Government farms to be "Model Farms."

As it may be of interest to your readers, I prepare to give a detailed account of this unique institution—in India,—and of the work which is being performed in it.

Founded and opened just two years ago, after a long struggle against the conservatism and sluggishness of the Madras Government, it started with almost everything against it; half-hearted support, faint praise, coldness, want of proper accommodation, inadequate staff, and many other things; but nevertheless, in spite of doubt and parsimony, it has struggled on, and is now capable, if only the Goverment, which turned out the fledgling to struggle against obstacles which have always been carefully removed from the way of medicine, or of civil engineering, will duly support it, of being developed into one of the most valuable institutions in the land. It is however doubtful, to judge from their apathy in the matter, whether "in Madras, the Government shows the least belief that such institutions are wanted in the country at all," as you expressed yourselves in your last number. Though it has been in working order for two years, no more than one class of students, that taken in at its commencement, has as yet been under tuition. The college is in vacation at present, but re-opens for work in September; there has however been no notice published as yet regarding the entrance of another class, so that it is presumable that none will be entertained until 1879, or until after the present class has finished its course. Is it possible that it is intended to allow the institution to die out? Such an idea is scarcely credible, but when Government rely on the *ipse dixits* of such men as Mr. Cotton, who spoke at the Society of Arts recently, there is no knowing to what folly they may not be led, forgetful of the fact that all education is slow to produce very clearly visible results, and that in this country, where our farmers are sunk in ignorance and superstition to an unheard-of-elsewhere degree, agricultural education can only be expected to bear fruit after long years of hard, persevering and almost thankless exhausting toil.

The routine of the College may be esily described; the students assemble at 6-15 A. M., and from that hour until 8 A. M., devote themselves to the work proceeding on the farm; on two days of the week, however, they have classes, one for surveying, and the other for agriculture. From eight to nine is a lecture hour daily, excepting on Saturdays, when the weekly examination in some one of the subjects tought is held. This last system, which is copied from the Royal Agricultural College, England, is one which commends itself most strongly to all educationalists in India; it is being adopted largely in England, especially in scientific schools; the marks awarded, in these examinations, to the students, all count towards their place in the class at the end of the lesson, so that steady work throughout the lesson can alone land any one in a place of honor, and there is no danger of that fictitious knowledge acquired by sudden cram just before an examination, which is so common.

In devoting so early an hour of the day to lectures, much time, which might otherwise be most advantageously devoted to practical agriculture, is in a measure wasted; but for this Government is alone to blame, from not having provided accommodation such as would enable the lecturers to perform their duties at any other than the coolest hours of the day. The building at present in use as a lecture room, was erected a few years ago as a granary and office for the Sydapet Farm, but though well adapted for the purposes for which it was intended, it is not in the least suitable for educational purposes, and in starting in such a manner the earnestness of the promoters of the institution is most clearly shown. This *quondam* granary, now a college, is one-storied; the upper floor, which consists of one long room, 60ft. by 20ft., being used as a lecture room; there is only 8 or 9 feet of wall from the floor to the wall plates and the room is open to the rafters. Arranged in order to provide light and air close to the floor only, for the purpose of drying grains and seeds, the tops of the windows only reach about 4½ feet above the floor, and thus the means of ventilation when a large class is in the room, are tested beyond their capabilities, and the heat of the room becomes almost insupportable. Being devoid of any verandahs or sun-shades, wherever the sun may be shining a part of the windows must be kept shut, thus darkening the room which under the best circumstances is never too well lighted. If a sudden rain-storm, arises the class has frequently to be dismissed, owing to the necessity of shutting all the windows. Notwithstanding these easily removable disadvantages, which are a very heavy handicap against its fulfilling the hopes entertained of the College, it progresses steadily through all obstacles and may be said, if it only be left to develope itself and not be rooted up, checked in growth, and then replanted, to promise very well for the future.

On being released from the lecture room at 9 A. M., the students are free to spend their time as they choose until 3 P. M., when they re-assemble for class-room instruction, which lasts for one hour, and consists of classes devoted to book-keeping, a very necessary acquirement on the part of a farmer, arithmetic, mensuration, or surveying; these classes are followed by a lecture at 4 P.M. on one of the many subjects taught, and at five the class disperses, the labor of the day being ended. On Saturdays, however, there are no classes, only the examination is held, there being no work of any other description.

Regarding the course of instruction, it must always be acknowledged that it is ambitious, but it may be fairly asked what is the precise object of the course adopted? The Prospectus says: "this institution is designed to afford instruction in the science of agriculture, and in the practical application of sound principles in conducting the ordinary agriculture of this country." But are these objects attained or likely to be attained under the system now in vogue? There is little doubt that the objects mentioned will be gained, but there is great doubt whether such objects are what should be adopted by the premier Agricultural College of India. The fact is that in endeavouring to carry out these objects there is the greatest possible danger of the work of the institution becoming too theoretical. The result can only show what has been done, but, from what can be learnt, I have considerable doubts on this point. The knowledge—thorough and well founded—of the first principles of agriculture, and of the theory of husbandry are most essential to enable a man to adapt himself to any circumstances with which he may have to deal; no amount of practical experience gained under one definite set of conditions, can fit a man of itself to be immediately ready to meet another totally different set; but there is a presumption in favor of the man who is thoroughly educated in agriculture being able to do so, provided he possess power of observation and common sense. Every farmer, however, like every man who manages a factory, should understand the work of the meanest hand; he need not ever engage in actual manual labor, unless he is a poor man, for the devotion of his mental faculties to the proper guidance of the labor of his work-people is of far more value than the efforts he may make with his body, at a time in one place, when his eye is required to look after details in many spots. I refer of course to the former who can afford to employ labor, not to the petty peasant tilling 10 or 12 acres of land only.

Before closing I would call attention to Mr. Caird's assertion that we can afford to export food grains; in Madras at least there is no margin. Assuming that our 30 million population comprises 6 million families of 5 each, who consume daily 7lbs. of grain, (that is Mr. C. A. Elliot's estimate) they will require annually to feed them 15,330 million pounds of grain. Add to this seed grain for 20 million acres of land annually cropped, and a total of nearly 150 million cwts. are required. Our Government-irrigated arable lands probably produce no more than 10 cwts. per acre, or a total of 50 million cwts.; our unirrigated cereals probably 6 cwts. at the utmost, or a total of 78 million cwts; and our pulses 3 cwts. per acre or a total of 6 million cwts; making a grand total of 134 million cwts. thus leaving 16 million cwts. to be found by the produce of the Zemindary lands, which form one-eighth of the area of the presidency; this is possibly about what they may be able to account for. With such a state of things Mr. Caird's sanguine belief in India is not well founded, at least as far as this portion of the country is concerned, whatever may be the case in Northern India.

Madras, August 16th, 1878.

WATERING FIELDS.

INDIAN AND FRENCH METHODS.

SOME of our readers may be glad to have from us a few remarks on the various methods in use for spreading irrigation water over the fields. The Irrigation Department exercise no control we believe over the water, when it once leaves the canal, the system of watering being left entirely to the experience of the cultivator. To simplify the subject, we may say a few words at starting, on the application of water to vegetation generally. Water acts directly then on the plants themselves, or indirectly on them through the soil. For example, while land is fallow, water acts thereon by preparing nourishment for the future crop, but when the crop is actually growing the water acts directly on the plants. Besides thus preparing sustenance in solution for the roots, it exercises a mechanical action at this time, by giving young shoots the plastic stiffness that keeps them erect; spreads their leaves to the air, and washes them free from the impurities and blight that interfere with their vital action. When plants are watered, they absorb by their rootlets the food necessary for their growth. The surplus water is exhaled and evaporated, and a fresh supply taken up by the roots. This constant evaporation has the effect of keeping the temperature of the foliage below what the leaf would otherwise acquire from the direct rays of the sun. In order that the water may do its work efficiently, its temperature should be a little higher than that of the surrounding atmosphere, but the difference must not be too great. The temperature ought never to exceed 95° to 100°. If the water is very much colder than the atmosphere, it is likely to be injurious to the plant, and it is for this reason that it is not wise to water under a bright sun, as the temperature of the air is then likely to be higher than that of the water. In the evening and morning the reverse is generally the case, and the water having absorbed heat during the day, continues warmer than the atmosphere till the sun has attained some height the next day.

When plants are watered to excess, the growth of the foliage and stalk is encouraged to the detriment of the grain both in quantity and quality. The want of sufficient moisture, however, is prejudicial to all parts of the plant alike. To sum up briefly, the points requiring to be remembered in watering crops are :—

(a) The water should be freely exposed to the air.

(b) It should not be allowed to remain stagnant.

(c) Its temperature should be the same as that of the atmosphere, or a few degrees warmer.

(d) Watering should be resorted to as little as possible just before and during the formation of the grain.

The most common method of spreading water over the fields in India, is by *kiáris.* Under this method, the field is divided into a number of small plots, or *kiáris*, by low bunds of earth four to six inches high. This watering is carried on, by filling the *kiáris* one after another ; the water being let into one at a high level *first*, and, when that is full, diverting it into another, and so on, until the whole are watered. This system is similar to the irrigation by submersion practised in some parts of France, which will be spoken of further on. Another system is widely used in the North-West Provinces and Oudh, and is known as irrigation by *háthá* from the name of the long wooden shovel, or scoop, used for the watering. The field is divided into nearly parallel parts by small water channels, having at intervals of about 15 or 20 feet small round reservoirs, about two feet in diameter and nine inches deep, formed by excavating the soil at these places. The water is directed into the channels and reservoirs, and is then lifted or scooped from the latter and thrown over the field, by a large wooden shovel called the *háthá.* Less water is used by this method of spreading than in *kiáris*, and the cultivators have an idea that the beating down which the young plants suffer from the water being thrown over them is good for them. It is more probable that the benefit is due to the washing which the leaves of the plant thus get. With slight variations these are the chief ways of distributing water over the fields in India.

In France on the other hand, much attention is paid to the preparation of the fields for irrigation The channels for watering are laid out, and levelled with as much care as the main distribution channels themselves, the services of an engineer being commonly obtained so to lay out the estate that the water shall be distributed with the utmost economy. The object aimed at is to keep the water flowing gently over the ground in a uniform sheet, gathering the overflow in drains as the irrigation of each plot is completed, and using the water, over and over again for the lower lands of the estate, the system being carried on, till the water is exhausted. There are three methods of spreading the water over the field, and they are known by the following names.

(*a*) Irrigation by level trenches (*rigoles de niveau*)
(*b*) Irrigation by beds (*planches.*)
(*c*) Irrigation by submersion.

The method of spreading water by level trenches, is used with ground having a slope of 1 in 100 to 1 in 10. It consists of a series of level channels, which when filled, allow the water to overflow their lower banks in a thin film uniform throughout their length. These channels are placed 10 to 100 feet apart, and, being exactly level for the whole of their length, they follow the contour lines of the ground. The first channel receives the water from the canal, or feeder ; the second catches the water which has flowed over the land above it, and allows it to flow afresh in a uniform manner. The third channel fills the same office in its turn, and so on through the whole series. Clay, marl, and sandy soil are all considered suited to this kind of irrigation, but not so earth, having a porous sub-soil. Drains are provided at the ends of the channels to draw off the water in them when irrigation has been finished, the entrances to the drains remaining closed while the watering is going on. To prevent stagnant water remaining in the trenches, a drain is also made along the foot of the slope, and thus a continual circulation is secured, the water led away by the drains being collected at a lower level, and used again for the irrigation of low-lying lands." This method might be applied in some parts of India we think with great economy ; and it would not absorb so much water as the present wasteful method of *kiáris.*

The *second* method, namely irrigation by beds, is only applied to very flat ground. The land is formed into beds, 200 to 300 feet long, the centre being made higher than the sides ; the distributing channels run along the top of the ridge and at the hollow formed where two beds meet a small drain is cut. The distributing channel has but a very slight longitudinal fall, and it gets gradually narrower towards the end of the beds, its two sides being exactly on the same level. When the trench is full it overflows on both sides, simultaneously, and after flowing over the bed, the surplus water is carried off by the drains, and led away to irrigate land at a lower level. The beds are generally made 30 feet to 100 feet wide, that is a width of 15 to 50 feet lies on either side of the distributing channel along the centre ridge. Great economy of water is claimed for this method, and it is considered the most perfect way of spreading water of any, although the preparation of the land is costly. This method also would be very suitable to the great plains of India, but its first introduction would give our irrigation engineers some trouble, although when the ground was once made up, there would be almost no expenditure required on it for years.

The *third* method is by submersion, and is in all practical details, identical with the Indian method of *kiáris.* This way of watering is only used in France for small pieces of land. It is said to take half as much water again as either of the other methods, but is much resorted to where a deposit of silt from the canal water is looked for, to improve the quality of the soil. We regret that we have no detailed information as to the precise quantities of water consumed by each of the above methods. All that we know on this head is that the Indian method of *kiáris* is exceedingly wasteful, using half as much water again as the level trench irrigation, or irrigation by beds would do. The Irrigation Department has a large field of improvement open to it in this matter. We have but briefly touched upon it.

EDITORIAL NOTES.

WE have been intending for some time to notice Sir Arthur Cotton's evidence before the Parliamentary Committee on the subject of irrigation. Unfortunately his evidence is less valuable than it might have been, because the Committee, in examining him, went to work with a prejudice in their minds, and consequently, with a desire not to learn from him, but to expose what they regarded as the extravagance of his schemes. We do not say that in doing so there was any dishonesty of intention—on the part of Mr. Childers, for instance, who no doubt thought he might do good service by discrediting Sir Arthur's views, and whose questions were, therefore, expressly framed with the view of showing their impracticability. But the consequence is that Sir Arthur Cotton is made appear to propose a vast expenditure for the immediate purposes of famine prevention, whereas Mr. Childers was really examining him on his views as to what might be regarded as a complete system of canals for all India. It was easy in this way to get him to name enormous sums as capable of being profitably expended by a gradual development of an Imperial system of canals, and to create the impression that this magnificent scheme was Sir Arthur Cotton's scheme for the simple prevention of famine. Sir Arthur, indeed, when asked how far the Government of India might go in developing such a system as he had in his mind, was unwilling to fix a limit, and he even spoke of a thousand millions sterling, at the rate of ten millions a year—as if he had wished to shake his questioners out of their timidity. When asked to fix a more reasonable limit, he said £200,000,000, but he added, in reply to a question—"I do not say that would satisfy me, nothing would satisfy me." "I hope," said Mr. Childers, "you do not wish that to be put on record?" "Yes, I do. Every thing you do opens the way for something else." It is perfectly obvious that Sir Arthur Cotton was speaking—as his questioners had purposely led him to speak—of what might gradually be done in order to the perfect development by irrigation and water communication of the resources of the Indian Empire. He was not speaking—and it is manifestly unjust to criticise him as if he had been speaking—of the expenditure that was immediately practicable and urgently necessary for the mere prevention of serious famines. Accordingly, when Mr. Childers met him with what was meant for a crushing interrogation—"How do you propose that the money should be raised?"—he was perfectly justified in retorting—"I should not say; I know nothing about that, I am not a financier, I am only an engineer."

When we turn from this fencing with Mr. Childers, to Sir Arthur Cotton's answers to such questions as were, *bonâ fide*, questions for real information, the exactitude of his knowledge is surprising; and as regards the cost and probable returns of irrigation works for the great deltas of India and the plains of the Gangetic valley, his evidence is strikingly correct. When, however, he speaks of storing water and carrying canals over more uneven ground, it is probable that he is more or less in error. As regards all Northern India—Bengal, the North-West Provinces, and the Punjab—his estimate of £3 per acre for irrigation, with a considerable extent of navigation, is probably sufficient. It certainly would be so in Bengal, although some works, now in existence, have been more expensive. To this must be added probably 33 per cent. for accumulated interest during the period when irrigation is gradually extending up to the full extent of the area navigable, and till the full water-rate begins to be realised. He calculates working expenses, including maintenance and revenue management, at 3 per cent. on capital, or nearly Re. 1 on Rs. 30, which would probably be sufficient. In fact, as we have said, his estimates of capital cost and working are, as regards Upper India, surprisingly accurate. He calculates on a water-rate of Rs. 2½ per acre on the whole irrigable area, usually taken at 500 acres per square mile. We believe the average actually realised in the North-West Provinces has been something like Rs. 2·4, and about the same in the Punjab. There is, however, an owner's rate charged in the North-West Provinces in addition to the occupier's rate, and this would certainly bring the average up to Rs. 2-8. In Bengal, we need not expect to realise Rs. 2-8 per acre for an indefinite period, but we may look for Rs. 1-8 over the whole irrigable area in a few years. In Orissa, the greater part of the irrigable area is already being leased for five years at this rate. There is no reason why an owner's rate should not be levied in Bengal as well as in the North-West Provinces, except the unfounded one that it would be a breach of the terms of the permanent settlement—unless, indeed, the Public Works cess now levied be held to have superseded it, which we are not prepared to allow. Inclusive of such a rate, Rs. 2 per acre might be levied in Bengal. Here, too, the navigation receipts are likely to be large, and these deducted from working expenses would leave a balance of not more, we believe, than 12 annas chargeable to the irrigated acre, thus leaving Re. 1-4 to pay interest. The indirect returns would, of course, be enormously greater.

The Agri-Horticultural Society have recently received, as a donation to their Museum, from Sir Arthur Phayre, Governor of Mauritius, some specimens of the double cocoanuts of the Seychelles, coco-de-mer, (*Lodoicea Sechellarum*). As probably but few of our readers have seen these nuts, we would recommend those who are interested in objects of natural history, to pay a visit to the rooms of the Society, in the Metcalfe Hall, for the purpose. The magnificent palm which yields these strangely-formed nuts is confined to a very limited area, namely the Seychelles, and we believe all attempts to raise it elsewhere have failed. It requires a great length of time to attain maturity, in fact, nearly a hundred years, and it does not put forth its flower-buds before it is thirty years of age, and then the fruit takes ten years to maturate, it being, in the meantime, soft and full of a semi-transparent jelly-like substance. Medicinal virtues were, in former times, attributed to these nuts; they are now converted into various domestic utensils, the wood is also utilised in various ways, and the leaves are employed for thatching purposes and for basket-making. It is feared that in the course of time this fine palm will become extinct, in consequence of the pernicious practice pursued of destroying the trees for the sake of their nuts.

The Bombay Government contemplate establishing an Agricultural College in the Presidency, and the Madras Government have been asked to allow Mr. Robertson, of the Madras Agricultural Department, to proceed to Bombay to enlighten that Government as to the way it should go to work to imitate his success.

The Mozambique Opium Company promises well, by all accounts. Our readers are aware that the trial of the "first fruits" of African growth was very satisfactory. The pods are larger than those of Malwa and the juice when analysed in London, was found to be superior to that from Malwa and Patna. The Company was formed in Lisbon with a capital of ten lakhs of rupees. The first call amounting to one lakh has been recovered, and no further call will be made until the shareholders are fully satisfied as to the results of fresh trials that are to be made on a larger scale. Mr. Paiva Ropozo, of Lisbon, is the originator of the scheme; he was in Bombay a few years ago, collecting information as to culture. He went to Lisbon, got very liberal concessions (5,000 acres of suitable land at a nominal rent, with right to export free of duty for 12 years), returned to Bombay last year, and thence proceeded to Indore, where he secured a dozen native planters, whom he took with him to Mozambique. Unfortunately the place is unhealthy, but there is every hope of ultimate success.

But very little attention is paid to the cultivation of the plantain, the most valuable of our Indian fruits. The natives, as a rule, put down a stump and allow it to take care of itself, in some instances giving it more and in others less water than is necessary. Mr Harman, of the Bangalore Experimental Farm, has planted out nearly an acre of land with plantain trees with a view of ascertaining some facts concerning their growth, value of produce, &c. Mr. Cameron, of the Lalbagh, has gone to much trouble to make a collection of varieties with a view to ascertaining those best adapted for the table and most likely to thrive in Bangalore. The Lalbagh collection includes sixteen varieties.

The Punjab has sustained a severe loss in the death of Mr. F. Halsey at Venice. He did good service to agriculture at Umritsur, where he was agent for the Bank of Bengal, and latterly near Pathankot in the Gurdaspur district, where he had set up a large plant of English machinery, and where he proposed to develope the manufacture both of silk and of sugar. A sugar refining company, with a large capital, had indeed been formed under his management, and it is to be feared that no one will be found fit to take his place. The rearing of the silkworm and the extension of the mulberry has already extended much under his energetic care, and we hope has taken root in Gurdaspur and the adjacent districts, not to die away now that he is gone. Almost his last act was to furnish the Punjab Government with a report published in the *Agriculturist* for August on the silkworms and silk exhibited at the spring fair at Gurdaspur, and to offer on his own behalf liberal prizes to encourage the silk industry, and it is said the main object of his trip home was to select and bring out machinery for his agricultural and manufacturing enterprises.

Mr. M. R. de Quadros, writes to us from Bombay:—"I am cultivating bamboo in Goa, where it grows very easily. It can be propagated from cuttings. It is an easy cultivation, requiring no irrigation, and should be put down early in June when the rains set in. I mention this as I notice that Mr. Routledge is anxious for information on this subject."

Dr. Thomson of Jamaica took a much more sanguine view of the economic profit of bamboo culture than did Dr. King and other Indian authorities; and he has given the strongest proof of the sincerity of his convictions by resigning his post in connection with the Jamaica cinchona plantations in order to devote himself to bamboo culture for paper-making. Dr. Thomson, in addition, takes up the business of fruit exporter to the United States. Jamaica is well suited for the growth of all possible tropical fruits, the list including mangoes and mangosteens, and there is the grand advantage of a practically unlimited demand close by in the United States,—the markets of Europe being also open.

THE exports of oil seeds from this country are becoming very important. At present India exports oil seeds to the value of five and a-half millions sterling a year, instead of making oil of them and using the refuse for manure and cattle food, to say nothing about the extra cost of freight. European capitalists are wanted to set up oil mills in India, to give their names as a warrant for standard qualities, and then we might hope to make oil one of the chief articles of export. Clever enterprise would soon be amply repaid. In the few oil mills we possess, the oil is by no means made so cheaply as to leave no room for competition. The loss sustained by the country from the exportation of oil seeds is enormous. In one year four million cwts. of material for oilcake is sent beyond the seas, whilst the cattle are dying of hunger.

THE construction of a chemical laboratory has recently been sanctioned by the Madras Government in connection with the Madras School of Agriculture.

MR. ROBERTSON, Superintendent of Government Farms, not long ago addressed the Board of Revenue on the results of the experiments made in sub-soil drainage as conducted by the officers of the Sydapet farm. These experiments were begun in 1873; the next start was made in 1875, and the last though not conducted on the farm were carried out in close proximity to it in 1876. They were not designed to determine the comparative results they would afford. All the land drained was in a very bad physical state and quite unproductive, excepting under very favorable circumstances. Great difficulty was experienced in obtaining pipes. Mr Robertson says that he has not succeeded in draining efficiently any one of the experimental plots. The difficulties encountered in carrying out these experiments were far greater than had been anticipated owing chiefly to the peculiar physical condition of the soils and the very great and sudden changes to which they are subjected from extremes of drought and extremes of moisture. In the opinion of the Board of Revenue these drainage experiments have not achieved success, but they clearly indicate the advantage of continued experiment. If it was long before drainage experiments were brought to a successful issue in England, it is not to be expected that the desired end should be gained by one stride in India. The application of English methods to India shows that they are not exactly suitable, and that there are, in this country, peculiar difficulties to be contended with in the blockage of pipes by silt, formed seemingly by the extreme dryness of the surface soil, cracked by the heat of a tropical sun. This may possibly be obviated in some measure by the means which Mr. Robertson proposes to adopt. Stone-draining proved more expensive than piping and a complete failure except for a time. While the drains were in working order the crop obtained was an improved one, which indicates that a satisfactory system of draining suitable to the peculiarities of the climate is a desideratum to be further pursued. As far as they go, the results are in the direction of progress, and the experiments should be continued.

AN extensive beet-seed grower, M. Legrand, has devoted many years to the production of special "races of sugar-beet," combining qualities appreciated alike by the manufacturer for richness of juice, and by the farmer for weighty returns; he has established a laboratory on the borders of the Quai d' Orsay, at the Paris Exhibition, where free lectures are delivered, instructing persons how to estimate the richness of the juice. M. Legrand cultivates about 1,000 acres of land, of which 150 are in Germany, almost wholly devoted to raising beet seed, 800 tons of which he grew last year. His *Franco-German* variety is much prized, even by foreigners, who raise the root for sugar. The prospect of the beet crop this season is not bad; early sowings however will turn out the best.

AN official circular from the Beet Sugar Company of Maine, is evidence that something practical in the way of making beet sugar in that North American State is intended. The circular contains directions for cultivation, and a statement that more than 2,000 farmers have interested themselves in this enterprise. The production of a sugar-beet from which sugar can be manufactured at a profit, is still a matter of experiment. The soil and climate of any locality are important points, and success cannot be assured until these are known to be favorable. The business is one in which success depends upon the exercise of small economies, as well as skilful management—for example, the utilization of the refuse pulp is a matter of no little importance. The profit in this last item alone, has often sufficed in European factories to turn the balance towards success, and neglect of it, has resulted in a failure of the whole business.

THE *Agricultural Student's Gazette* calls attention to the cultivation of gorse or furze as a valuable fodder plant. Gorse botanically belongs to the order *leguminosæ* of which it forms a distinct genus; *ulex* and the species generally seen is *europæus.* It is a bushy shrub with short thick spreading spines covered with prickles and bears a yellow flower. As a fodder it contains much more solid matter than either turnips, mangold or carrots—and a large amount of nitrogen or flesh-forming constituents. It is hardy and grows on any soil—even of the poorest description. It was introduced on the Neilghorries some years ago—and in a few places may be seen doing duty as a fence. Neglect has turned it into a nuisance, for rats burrow at the roots and probably devour them. The whole hedge thereupon becomes one mass of tinder which a spark will set into a blaze. The objection to the use of gorse or furze as a fodder is the spikes or prickles which grow on the spines, but these may be crushed far more easily than the formidable thorns of the prickly pear, which, by a simple process, is turned into a valuable article of food during the dry months. The method of cultivating gorse is simple. The land being cleaned and the soil pulverised—the seed is sown broadcast before the early rains of March or April; about 20 lbs. of seed per acre are wanted. The plot should be kept free from weeds and one or two hoeings would be beneficial, as the young gorse is delicate. In six months the crop is fit to be cut, and the cutting may be continued regularly till Christmas. The yield will be from seven to ten tons per acre. Horses as well as cattle may be fed upon gorse.

A NEW means of preventing the destructive attacks of insects upon vegetation is said to have been discovered in the employment of an oil obtained from the seeds of the *Elæococca cordata*, already extensively used for that purpose by the "Heathen Chinee." The plant, which belongs to the Euphorbiaceous order, grows in a wild state along the Mediterranean coasts, and there is some talk of cultivating it in the south of France, in the hope of finding in its seed-oil a specific against the phylloxera.

THE *Arachis hypogæa*, or earth-nut of tropical America, has been used on a small scale in Southern Europe for a considerable time, more especially in the South of France, where an oil is extracted from it which is employed in the adulteration of olive-oil. It is only of quite recent date, however, that it has been imported into Europe in anything like considerable quantities. A Hamburg house is now engaged in manufacturing oil from this source upon an enormous scale, and the cake obtained in its process is found to possess a high value as food for cattle According to an analysis carried out by Dr. Stohmann, at the Halle laboratory, it contains 29·25 per cent. of nitrogenous, and 25·67 per cent. of non-nitrogenous nutritive matters, 11·18 per cent. of fat, 21·11 per cent. of woody fibre, 5·01 per cent. of ash, and 7·78 per cent. of water, and is, therefore, to be considered rich in albumen and fat. Latterly its value as a feeding stuff has been increased by removing the hard rind of the nuts before pressing them, whereby the cake contains less woody fibre, and a higher proportion of other nutritive constituents. The mild, agreeable taste of these cakes is said to be highly appreciated by cattle fed upon them, and in the case of milch cows the milk is of exceptionally delicate flavour.

* CONSUL-GENERAL PLAYFAIR in his last report on the trade and commerce of Algiers, state that the traffic in Alfa continues to increase, several establishments being in course of erection for reducing it to pulp on the spot, thus saving carriage and freight. The largest quantity of Alfa is gathered in the sub-divisions of Sidi-bel-Abbes and Mascara, and almost the whole of it is shipped at Oran. The latest return (namely, that for 1876) shows that 58,759 tons were exported in that year to England, France, Spain, Portugal, and Belgium. The Ramis plant *(Bœhmeria nivea)*

promises to become one of the staple products of the country. The experiments made with it in the province of Oran, especially near Relizane, and in the plain of the Habra, have been satisfactory.

The rape crops in many parts of Bohemia are seriously damaged by the attacks of an insect plague. Specimens have been sent for examination to Professor Nickerl, who finds them to be infected with the maggot of the *Cecidomyia brassicæ*, which live in the unripe pods and abstract the juice from the seeds by suction. As many as fifty or sixty are often found in a single pod. The full-grown larva of this insect assumes the pupa stage in the ground, and emerges thence as a small, dark-coloured gnat in ten days or a fortnight. No effectual method of destroying the plague has as yet been discovered, and all that can be done is to pluck the affected pods, as soon as their yellow shrivelled appearance betrays the presence of the enemy.

At the Paris Exhibition are shown, from Mauritius, some bales and samples, well prepared, of the fibre of the *Fourcroya gigantea*, termed aloe-fibre. Regular plantations have been made of it on the island, and improvements introduced in the mode of preparation, though in this respect much remains to be done. The initial success of this industry is chiefly due to the exertions of M. Bourgignon, but M. E. Tronchot also shows the fibre. The plant grows in a wild state in the most arid soils, serving to cover much of the uncultivated land. It furnishes without steeping, but after a simple crushing, long filaments of great strength, cleaned after washing by a simple process of combing, the fibre shipped to England has sold at a very remunerative price. It is employed for making ships' cordage, which is stronger at equal weight than that made from the best hemp, and is unaffected by water. The value of the shipments of this aloe-fibre, which from 1872 to 1875 averaged but £4,000, reached in 1876, £7,216.

We observe that the philosophical faculty of Gottingen has offered two prizes of 1,700 and 680 marks for the best works on the causes affecting the change in chemical composition of plants of the same species, such as climate, soil, fertilisation, &c. They must include a critical review of all facts hitherto gathered on this subject, and suggestions as to the best methods for completing out knowledge in this department, accompanied by the results of independent research in the directions indicated. Competitors must forward their work before August 31st, 1880, and the decision will be announced March 11th, 1881. They can make use of Latin, German, French, or English.

A German naturalist, Tulberg, suggests the industrial application of the products of the mussel. The well known *byssus*, or strong silky threads which these animals spin in order to fasten themselves to rocks and stones, is pointed out as a probable raw material to rival the somewhat similar threads spun by the silkworm. The threads of the *pinna*, a mollusc allied to the mussel, have been worked into fine fabrics and made into gloves, and have, for a long time, been in common use among the poorer class of girls and women in Italy for such purposes. The toughness of the *byssus* of the mussel is a strong recommendation in favour of its adaptation to some such use.

In an article on the proposed increase of the tobacco tax in Germany, Dr. R. Schleiden states that in Thuringia alone some 20,000 cwts. of dried beetroot leaves are annually passed off as the genuine fragrant weed. The same leaves, as well as those of chicory and potatoes, are largely used for a similar purpose in Magdeburg and in the Palatinate. The " Vevey " cigars, so much favoured in South Germany, contain no tobacco at all, but are entirely composed of cabbage and beet leaves, deprived of their natural smell and taste by a special form of cultivation, and subsequently steeped in tobacco water for a lengthened period.

Intelligence received from Resht, announces that the silk crops in those parts is likely to be a failure this year. The greatest part of the silk-worm eggs imported from Khorasan have turned out to be spurious, and microscopic observation had foretold the worthless nature of those produced in Ghilan. The crop is expected to be much worse than even last year's crop—and that was the smallest crop ever known in Ghilan.

In Monghyr last year the poppy and the grain crops it will be remembered were attacked by caterpillars, a soucre of loss which was first brought to the notice of Government by the officer of the Opium Department. Spicial enquiry has been made, and the result appears to show that the ravages of these insects were due to the very intermittent character of the rainfall. In ordinary seasons they are drowned by the continuous rain, nothing has been heard of them during the current year.

COMMUNICATED AND SELECTED.

COMPOSITION AND QUALITIES OF BATS' GUANO.

The Royal English Agricultural Society contrives to make its bi-annually-issued *Journal* fresh, interesting, and useful to agriculturists. Its talented and energetic editor, Mr. H. M. Jenkins, and the *Journal* Committee, generally manage to procure papers from the best authorities on new and engrossing topics. Then Dr. Voelcker, the accomplished chemical adviser of the society, loses no opportunity of throwing light on any new feature connected with his department. The papers which he contributes to the *Journal* commonly rank among the most popular, and are perhaps the most serviceable in the volume. In a late number the distinguished chemist furnishes a very interesting report on bats' guano, which is one of the more recent discoveries of manurial deposit in foreign countries.

Dr. Voelcker says that, so far as he has been able to ascertain, bats' guano is to be found in the south of Spain, in the Bahamas Islands, in several of the East Indian islands, in Jamaica, Arkansas, and Texas. It consists of the dead bodies and dung of bats, in a more or less decomposed state, mixed with variable quantities of sand or earthy matter The common colour varies from light to dark brown; some of it being dry, powdery, and mixed with wings of insects. A good deal of it has been found of a darker colour and free from smell. Even in the best of it there is not much smell of ammonia.

It is found in caves " inhabited by innumerable bats, attracted to the neighbourhood of the caves by swarms of insects, which infest certain swampy districts in semi-tropical countries, and which afford abundant food to the winged mammals. The most extensive accumulations of bats' guano appear to have been found in numerous rocky caves in Texas and Arkansas. Some of the caves yield comparatively little guano, others many hundreds of tons; and from 15,000 to 20,000 tons are reported to have been taken from a single cave in Texas. The number of bats frequenting the caves amounts to millions, and when they issue forth they darken the air as if a great volume of smoke were pouring out from the opening. Caves covering miles of ground, and inhabited by innumerable bats, are also found in Arkansas; and there can be no doubt that the caves in Texas and Arkansas contain large stores of bats' dung, of sufficiently good quality to be usefully employed for agricultural purposes."

Detailed analyses is then given of two samples of bats' dung brought from Arkansas and submitted to Dr. Voelcker's examination. The one was an old deposit, and was dry and earthy in appearance, the other was a fresh deposit, and was damp, lumpy, and dark in colour. The latter sample, in spite of its wet condition, yielded 8·04 per cent. of ammonia and 8·4 per cent. of nitric acid, representing 13·22 per cent. of nitrate of soda, and containing 2·18 per cent. of nitrogen, equal to 2·65 per cent. of ammonia. There was thus 10·69 per cent. of ammonia in the fresh sample, which was largely made up of fragments of insects' wings. Of ammonia it had no " pungent smell." Of the phosphoric acid in this sample, about a half was soluble, and the whole was equivalent to about 8 per cent. tribasic phosphate of lime. The quantity of nitrates, says Dr. Voelcker, " together with much nitrogenous organic matter, is rather remarkable; the material, however, was light and porous, offering free access to air; and under these circumstances the nitrogen of the fresh excreta would give rise to the formation of nitrates."

Although considerably richer in phosphates than the fresh sample, the old deposit contained scarcely half the organic matter and salts of ammonia, and a good deal less nitric acid than the fresh. Moreover, the old sample " was unfortunately contaminated with so much sand and valueless earthy matter, that, unless the cost of transport be moderate, it would hardly appear worth the expense of exploring the caves in which such deposits occur. The fresh deposit, on the other hand, is a valuable manure that would probably realize about £10 a ton in the market."

Four other samples which it was understood, came from Arkansas or Texas, were some time ago subjected to a complete analysis by Dr. Voelcker, and showed widely different results. Nos. 1 and 2, though fairly dry, were very poor in organic matter and ammonia. Of nitrogen equal to ammonia, they had only ·59 and ·58 respectively. The first sample was also very deficient in phosphate of lime and nitrates, besides being much contaminated with carbonate of lime, sand &c. Containing as it did, only about ½ per cent. of ammonia, scarcely 1 per cent. of nitric acid, and only 5 per cent. of phosphate of lime, "it was not worth removing." The second sample, similar in nitrogen to the first, contained about 6¼ per cent. nitric acid and phosphoric acid, representing 54½ per cent. of tribasic phosphate of lime. This sample, at present market value, was estimated at about £7 per ton.

The third sample contained no less than 64 per cent. of water, nevertheless it yielded about 3½ per cent. of ammonia and 3 per cent. of nitric acid, in a dry or proper state of division. This sample "would be a valuable manure." The driest of the lot was No. 1, which was also richest in nitrogenous matter. The percentage of nitrogen in this sample was 7·89—equal to 9 58 per cent. of ammonia. The phosphoric acid represented about 18 per cent. of tribasic phosphate of lime. This manure was valued at about £11 per *ton*.

So long ago as 1870, a sample of bats' guano, *from* Spanish caves, was sent to Dr. Voelcker. It was damp and dark-coloured, containing 33 per cent. of moisture, nitrogen equal to 4 per cent. of ammonia, of phosphate of lime 7 48 per cent., and insoluble siliceous matter 32·50 per cent. This was not a good manure, but two samples brought from the same country a couple of years later produced better results, one of them yielding nitrogen equal to 10·52 per cent., and the other 6 02 per cent. of ammonia. Neither, however, was very rich in phosphates, nor largely composed of insoluble siliceous matter. A subsequent sample, also from Spain dark coloured, full of fragments of insects, gave a still better analysis. The nitrogen equalled 10·81 per cent. of ammonia, and the tribasic phosphate of lime nearly 12 per cent.

Only one sample of this guano from Jamaica has been sent to Dr. Voelcker. It was brown-coloured, and yielded 23 per cent. of moisture, nitrogen equal to 1·53 per cent. of ammonia. It had 31·49 per cent. phosphate of lime, and was thus fairly rich in phosphates, though poor in ammonia. A sample from Penang yielded 38 per cent. of phosphate of lime, 6 per cent. alkaline salts, including 2¼ per cent. of potash. The phosphates and salts of potash make this lot a useful fertilizer, but it is very poor in organic matter, and shows less than ¼ per cent. of ammonia. It is extensively used as a manure by the sugar planters.

It appears that the greater quantity of bats' guano imported into England comes from the Bahamas, and is known in the commercial world as Bahama guanahani guano. Of a dark-brown colour, with little smell of ammonia, it often contains small particles of lime stone, which presumably "constitute the cavernous rock in which the accumulations of bats' excrements are found. Guanahani is often too damp and lumpy for direct application to the land in its natural condition, and requires to be dried, sifted, or otherwise manipulated before it can be used with advantage for agricultural purposes." Six average samples, representing cargoes lately imported into this country from the Bahamas, have been carefully analyzed by Dr. Voelcker. With one exception, these samples were very deficient in nitrogenous organic matters. There were some nitrates in all the samples, and a fair amount of phosphate of lime—the average ranging from 27½ to 46 per cent. Considerable quantities of carbonate of lime were discovered in all the samples, save the one which stood highest in ammonia. The details of further analyses are given, to show the varying proportion of soluble and insoluble phosphates. From the results of analyses Dr. Voelcker says "The Bahamas guano is not suitable as a manure for corn crops: but, like other phosphatic guanos, it may be usefully applied to root crops or to worn-out pasture land." He very prudently advises "that Guanahani guano, of so variable a composition, should be bought on the strength of a guaranteed analysis at the market rates at which ammonia and phosphate of lime can be bought at present in similar circumstances." It thus appears that bats' guano varies greatly in its value as a fertilizer. The valuable report before us gives, in conclusion, that some of the manure contains as much as 10 per cent. of ammonia, some even less than 1 per cent. and the estimated money value ranges from £3 upwards of £11 per ton.

A NEW MATERIAL FOR PAPER.

A NEW material for the manufacture of paper has been recently discovered in South America. The parties interested are rather reticent about the facts connected with the matter, but enough is known to warrant the statement that the discovery is looked upon as important, and it will likely have considerable effect on the manufacture of paper in America as well as in Europe. The article grows wild, and to a great height, as when full grown taller than a man, and in some cases reaching higher than a man on horseback. It is of a brown color in its natural state but is easily bleached to a pure white. It is said to be stronger than hemp and the samples shown confirm the statement. A party of English, capitalists have taken hold of the matter, and have made a contract which they claim is exclusive for gathering and exporting it.—*Madras Times.*

EXPERIMENTAL FARMING IN MADRAS.

THE annual report of the Superintendent of Government Farms for the year ending March 31, 1877, is possessed of unusual interest. Curiosity is stimulated to see if hot and dry weather had the same withering effect at Sydapet as over the rest of the Presidency, and how far a correct treatment of the land is an antidote to extreme conditions of the atmosphere. The subject is of concern to vast numbers of people, when it is reflected that, out of a population of thirty-one millions under the Madras Government, two-thirds are directly or indirectly employed in agriculture, and that the period comprised in the report was for them one continuous record of disaster. The Carnatic cannot be deemed a favorably situated agricultural country. On the contrary, this report shows very strikingly that the people are exposed to seasons which are uncertain and varying. Even the rainfall register of this part is stated not to be of much use to the agriculturist. "It is of far more importance for him to know how the rain of a district falls, as a guide to the climate of it, than the total fall." The peculiarities of rainfall at Madras are worth noticing.

During the year to which the report appertains, there were only twenty-two days fewer than usual on which rain fell, yet the deficiency from the average of the past ten years was 29·38 inches in the total fall. Taking the Madras Observatory averages of sixty-three years, it appears that from January to June the rainfall is almost nominal, one, or at most two wet days—and these are red latter days in the Almanac of the Madras agriculturist—a month, with from a half to one inch at a time. For July, August, and September, the influence of the south-west monsoon is felt. Upon the Malabar Coast rain falls day and night for most part of these three months; some blows over to Madras; and rather more than a third of each month consists of rainy days. The amount precipitated is from three to four times as many inches as for the six months preceding. 1876-77 had a fair south west-monsoon, but the rainfall at Madras for October and November shows that the north-east monsoon turned the tables. They are generally the months of the heaviest rain. Half that of the annual total comes down in these two autumn months—the "fall" period of the Madras year,—when about three days a week are rainy. Instead of this there were only seven falls over one inch each, and four light falls under an inch. December tails off with a little more that five inches fall, during three days a fortnight in average years. But the total rainfall of 29·88 inches, when compared with the 48·91 inches to be expected by Observatory averages, is sufficient to prepare the reader of the Sydapet report for moderate returns from even highly cultivated lands. Indeed, the jerky character of the rainfall tabulated in the best years indicates the neighbourhood of Madras, as a locality in which farming is carried on under great disadvantages. It is often under severe conditions that refined and ingenious processes are to be found introduced into agriculture. But it is needless to say, there are none of the sort amongst the population of Madras, and the natives have still to be taught the rudiments of the agricultural craft. An Experimental Farm, such as that at Sydapet, is of the highest value in demonstrating how a naturally irregular climate may be no obstacle to the production of a meal for every one in the Presidency. Even irrigation may be dismissed from view in the matter, for singularly enough the season of 1876-77 pressed most on the wet land cultivators using tank water. For dry lands the Superintendent of Government Farms asserts there was sufficient rain to mature fair crops of cereals, pulses, cotton, and indigo. There is usually a sufficient frequency of rain from June to December for arable cultivation, only "owing to the high temperature that usually prevails, if a considerable lapse occurs between two falls of rain, all the bad effects of a prolonged drought will be seen." The agricultural value of the rainfall at Sydapet for the year is concisely given as follows in the report:

"Rain fell during April on only one day, which is about what is usually the case: in May, 3, slight falls, amounting in all to 55 inches, did not attain the average of 10 years by nearly an inch; during June the same contrast with the average of previous years continued, the rainfall being only 2·82 inches on 5 days to an usual 3·14 inches in six days. July was marked by numerous small showers, falling chiefly during the latter part of the month, according to the general custom, which, though more numerous than usual, the register shows, to have been lighter. In August very light showers, instead of the usual falls of medium amount were, until the last week, registered; these were insufficient for cultivation, but tended to promote the growth of weeds; in the last week however a considerable fall occurred, which would, had September continued as it began, have enabled dry crops to have been grown with ease, and what were sown would not have been ruined by the drought, which set in after the 5th of that month, and to which must be attributed much of the loss of crop on dry lands during the past season; the deficiency of rainfall during these two months was 4·76 inches, whilst there were seven fewer wet days. The failure of the north-east monsoon rains in October and November, was the cause of the failure of the wet crop, because the tanks, which these rains usually replenish, were not filled ; the deficiency of rain amounted to nearly 16 inches, and there was a corresponding decrease in wet days. In December the same failure continued ; and during the three concluding months of the year there was scarcely any rain, only a very slight shower in the middle of January, and a sprinkling in March too slight to register."

It is possible by cultivation to change the constituents of a soil, and thus to render a soil adapted to a cereal crop in the second year by growing a leguminous crop the first. Rotative culture has the property of economising labor by spreading the seed time more over the season, and it extinguishes tribes of weeds and hordes of insects. Mr. Robertson gives a useful table of rotations adapted to a Madras holding of twenty acres, *viz.*, for the first year, corn crop and cotton, 2nd year, indigo ; 3rd year, corn crop followed by a catch crop of pulse ; 4th year, guinea grass ; 5th year, guinea grass. But for stiff strong rich soils an alternative rotation runs as follows :—

1st year—Corn and cotton.
2nd year—Indigo.
3rd year—Corn and gram as summer crop.
4th year—Cholum cut green, followed by a leguminous crop, and by gingelly as a summer crop.
5th year—Indigo.
6th year—Cholum and gram as catch crop.
7th and 8th years—Guinea grass.

The only crops under these rotations sold off the land would be cotton and indigo, the grain being used by the people, and its essential mineral components ultimately finding their way back to fertilise the land.

Turning from the routine to be observed, to results actually obtained at the Government Farm during a year unexampled for the failure of crops grown under the native system, the report is specially instructive. A plot, 3¼ acres in extent, of white cholum, was sown on the 8th December 1876, after a week's dry weather which followed a fall of 1·55 inches. This was reaped on the 3rd March 1877, only three wet days occurred during all this time, and the rainfall was but sixteen-one-hundreth of an inch, or 3,621 gallons per acre, a quantity of water which could be held in four and thirty large casks. Yet a crop was reaped of 66lbs. an acre grain, and 3,103lbs. an acre straw. The crops which had been sown in October gave much better returns. Sorghum evidently pays well in the dry season :

The sorghum crop was grown on a piece of light sandy loam, which had no fallow during the previous year and was heavily manured with box-manure ; the crop was also top-dressed with saltpetre, and, to the thoroughly cultivated and high manurial state of the land, the result obtained may be attributed. It will be seen that the seed sown was as little as could possibly be used with any good results, but it is probable that, had the crop been slightly thicker on the ground, the results would have been better."

The yield per acre after 100 days growth was 921lbs. grain and 5,103lbs. straw. The white cholum produced by 0 16 inch of rainfall. cost Rs. 13-6-0 to cultivate, allowing for unexhausted manure, and the outturn was worth Rs. 14-11-8 per acre, so that the cultivation under almost unexampled difficulties was attended with a small profit The sorghum gave a profit of 31½ per cent. on Rs. 48-1 3, the expense per acre, with a rainfall of a little less than 5 inches. With the help of eight waterings, added to a total fall of 3·9 inches, a plot sown with maize for fodder on the 8th November gave by the 6th February at the rate of 12,226lbs. fodder per acre. The field had 12 cart-loads of stable litter, and a top-dressing of 50lbs. saltpetre. Even cotton throve.

Madras experience shows that there is a great difference between the amounts of wool afforded by the cotton tree at different times of the year. It is best to sow the plant a month earlier than is generally done, or in August, to begin picking in December, and not to leave cotton standing on the ground after July, when the showers make it difficult to keep down the weeds. Deep cultivation, combined with heavy manuring, enabled the farm to dispense with irrigation in producing fair cereal crops. From test measurement of the "headlands" of fields which are more or less shallow, ploughed like the land farmed by the natives, it was clear that without deep cultivation the yield even with manure would only have been a seventh of what was obtained. That the natives were without crops on their feebly manured dry lands was inevitable. Twenty-one ploughs were made up at the farm for the districts, modified from the American pattern. As they cost Rs. 20 each, and largely supersede the necessity for the irrigation of dry crops, it might prove sound economy for the State to go to some expense, and distribute iron ploughs broadcast over the country to all the natives who are disposed to try them.

The noticeable features in the live stock breeding experiments of the Farm are that the cattle bred for draught in this country stand higher at the quarters than behind the hump, which tends to throw more weight against the yoke. The length of leg, however, as compared with depth of barrel is an excessive and general defect in the cattle of the country. Girth measurments, also contrasted with those of English breeds, show how small the cattle of the country really are. A pure short-horn bull calf at Warwick girthed 6ft. 1 in. against 5ft. 8in. girth of a Mysore bull. The sheep on the farm up to the age of two years increase considerably in weight, but after that age there is very little material alteration. Hence it is necessary to give strong nourishing food to sheep under two years old, if it is desired to obtain well-formed and well-grown stock. For every 10lbs. of live weight, the sheep produced on an average 4·95 oz. of wool, an amount which compares not unfavorably with that yielded by the English short wooled breeds of sheep. Thus it is seen that, whether in grain or stock farming, though the prospects in Madras are not tempting to the European capitalist, and the weather is liable to discourage the more moderate expectations of the native, fair means of livelihood were within the reach of an intelligent cultivator, in the worst season that Madras has yet had to record.

REANA LUXURIANS.

Notes on Reana luxurians syn. Euchlæna luxurians,—a newly introduced forage plant. By the Secretary of the Agri-Horticultural Society of India.

OBSERVING in one of the monthly journals of the Acclimatation Society of Paris in 1876, a very favourable notice of a fine forage plant, termed *reana luxurians*, which had been introduced into the Botanic Garden at Bourbon, I applied to the Director of the Royal Garden at Mauritius on the subject. Mr. Horne kindly sent me a small quantity of the seed, and afterwards, on a second application, a further supply. This grass is a native of Guatemala, where it is known by the name *Teosinté*, an antique name signifying "grass of the gods." It is most favourably reported on by the Director of the Public Garden at Guatemala, as possessing most nutritive properties, the stalks containing an abundance of saccharine matter. It forms enormous tufts, a single one being sufficient to supply an ox with food for a day. The leaves resemble those of Indian corn, but are much broader. M. Ch. Naudin states in the Journal of the Acclimatation Society of Paris for September 1876, that this *Teosinté* is *Tripsacum monastachyum.* Both despatches of seed were distributed (last year 1877,) to several members of the Society (whose reports were altogether satisfactory), and a small plantation was established in the Society's garden. From this, a large quantity has been gathered, as the grass seeds profusely, and has been distributed during the first half of the current year to upwards of one hundred applicants throughout India for sowing in the rainy season.

The seeds should be sown, in a nursery bed in June, and transplanted when two or three inches high, six feet being allowed on all sides for full spread, as it becomes very bushy, and the more space allowed the better for its development.

The following translation of a paper by M. A. Vinson which appears in the *Bulletin Mensuel de la Societé d'Acclimatation de Paris* for December 1877, may be of interest in connection with the foregoing remarks :—

The *Teosinté* is a most valuable plant. It is a fine grass, of great height, holding a middle place between maize, sugarcane, and job (*Coix lachryma*), but approaching nearer to maize than any of these three kinds of grass. Following the procedure of Darwinism, we can easily see in the *Teosinte* the ancestor of maize. This plant has a strong stalk, and as its specific name implies, the vegetation is luxuriant. Originally from America and the Republic of Guatemala, it has been known to us since the 14th July 1875, by the Acclimatisation Society, under the name of *Reana luxurians.* Its acclimatation in France, tried first under the care of M. Durieu de Maisonneuve, Director of the Botanic Garden at Bordeaux, has been more recently renewed, thanks to the despatch of seeds by M. J. Rossignon, Director of Gardens and Public Promenades at Guatemala. The annual plant taking nine months for its complete development, perishes always from first coldness of the temperature, even if placed in a green-house. One would suppose till then, looking only at its dried stalks, that it was a bamboo or a sorgho. M. Thuret obtained at Antibes a first developement of the inflorescence before, or just at the time of, its being killed by the first frost. Then M. Durieu de Maisonneuve was able to know for a certainty, that this grass belonged to the genus *Reana*, and that it constituted a twelfth species, the first being *Reana angustifolia.* Without having, says M. D. de Maisonneuve, a claim to give it a name, I have provisionally placed it under that of *Reana luxurians* on account of the wonderful development of its organs of vegetation.

The seeds of *Teosinté*, sent to us from Reunion, planted in September have germinated in about seven days. The plant springs up like maize, with which one would confound it on its earliest stage. Afterwards, in its second period of growth, it seems like the Coix, and it is not till it has attained its third phase of development, that it takes a decided personal character, and only resembles itself.

The *Teosinté*, genus *Reana*, is quite on the side of maize, genus *Zea.* Its terminal male flower is quite like our great grasses, and its female flowers, more numerous, separated and hidden under them, in the axil of leaves of a beautiful green, are fecundated from above by the pollen which escapes from the male flowers situated at the end of the stalk. The lateral stalks alternate, rising up from both sides towards the sky.

Each female inflorescence is composed of spikelets of five within the middle with morsels of beard, as at the termination of the spikes in maize. The joints bear alternately a bunch of spikelets enclosed in one bract or common valve ; and the seeds enclosed in their turn in an inner and proper glume are adherent the one after the other in rows rather than in a garland. They have the appearance of the little canine tooth of a child, of the color of amber or greyish, of a slate color, or even brown when the grains are well matured.

The trunk of the *Teosinté* sends out a great number of stalks and many roots, white or redish, of a purple color like dregs of wine. A field which I have planted by measurement, and two seeds for each hole, prepared as for maize, without manure, has rapidly and completely closed up like a field of cane, between the furrows of which there is no passage. The tufts in it are admirable—splendid.

Mules, horses, oxen throw themselves on the cuttings and devour all, even to the stalks and roots; which shews it is a most saccharine vegetable.

It is as a forage plant that it recommends itself to us; but from its appearance, its growth and its resemblance to cane, its properties extend beyond extract of sugar from it; that is to say, from sugar and alcohol, because the stem is close and not fistulous.

It is said that one tuft is sufficient to feed two bullocks for thirty hours. This is no exaggeration. It is even below the truth.

The *Teosinté* likes cool and moist places; nevertheless, it flourishes in dry localities. In the island of Reunion its growth is remarkable; it seems suited to all parts. Mine were planted in September 1875, at St. Denis and at Salazie. During the month of May I gathered the ripe seeds. These seeds are even finer than those we imported, which is a good sign of acclimation. My plants have resisted during development the heavy rain and cyclone which we experienced. As to the trunk, which measures many metres, it is very high, it lies down on the ground, and is straightened again like sugar-cane and is not broken.

This fine grass has an undoubted advantage over sugar cane, maize, and joh: the leaves ripen during its growth, that it is to say, they evaporate excess of water in vegetation, so that animals run no risk of cholic, which is often experienced by them here from fermentation of green leaves of other grasses.

Every one to whom I have given *Teosinté* seed have been surprised by the profuseness of its vegetation and its suitability to our climate.

We have distributed the seed to many persons. We have done all we can to spread the culture of this useful and handsome grass. One plant alone, an ordinary one, partially eaten down by my mules, and on which there remained only five stalks, has yielded me 505 grammes of fine seed which I forwarded on 10th June to the Chamber of Agriculture, to be distributed to the residents of the Island.

These seeds, abounding throughout the length of the stalk, are excellent as food for draught cattle, for cattle reared for the shambles and for poultry. Owing to the hardness of the exterior envelope of the grain, the birds of the air will not attack them. Although the borer settles on the stalks of the *Teosinté* as on all the grasses we possess, yet it has not at any time hurt this luxuriant grass. It gives after cutting several shoots. The seeds falling naturally round the roots of my plants, have germinated spontaneously.

Since sugar-cane and maize, the *Teosinté* is the most important forage plant that has been introduced into the island of Reunion. Its seed can replace maize and yam; as a forage plant it is without a rival.

The following is communicated by the Director of Agriculture and Commerce, N.-W. P.:—the letter is dated 21st May 1878:—

In continuation of this Office No. 350, dated the 23rd March last, I have the honor to report on the experimental cultivation of *Reana luxurians* during the year 1876-77.

In February 1877, the Agri-Horticultural Society of Calcutta sent to this office a small packet of seed with instructions how to sow it. This was distributed among the three gardens of Saharunpore, Cawnpore, and Allahabad, and the superintendents were desired to cultivate the grass very carefully, and to take steps for producing a sufficient quantity of seed for future experiments.

From the reports received, it appears that *Reana luxurians* has thoroughly succeeded everywhere, and promises to be a valuable acquisition to the fodder supply of these provinces. Mr. Halsey of Sujanpore, Punjab, a practical agriculturist, who also tried the plant, writes as "follows:—" My *Reana luxurians* is in flower and seed forming. If it "will only ripen, it will be the most valuable plant introduced into "India for years. It is something like Indian corn, bearing the male "flower at the end of the stalk, while at every joint a cob forms like Indian corn." The plants did ripen, and we have now a sufficient supply of seed for carrying on more extensive operations during the present year. Besides the Government gardens, the canal *Rajbahas* near Cawnpore will be the field of the present year's operations.

The following is an abstract of the reports received from the different gardens.

Saharunpore.—Twenty-five seeds received from this department were sown in pots on the 16th of April, of which 13 germinated. When the plants attained a height of about one foot they were transplanted to different parts of the garden, care being taken to vary as much as possible the conditions of soil and exposure. Those planted on the edge of a pond succeeded best, their foliage being much more luxuriant, and yield of seed greater than those on drier soil at a distance from the pond. On November 18th the plants were in full flower, and one of them measured upwards of 14 feet in height. Some cuttings made in September were in flower in December. The plants on other parts of the garden were artificially irrigated, necessarily intermittently, the ill-effects of which were further intensified by the severity and long-continuance of hot weather last year. The Superintendent promises to make further trials this year, and to observe the behaviour of the plant growing in damp jungle. Many self-sown seeds have germinated this year on the edge of the pond.

Cawnpore.—Eighteen seeds were sent to the Cawnpore farm which were sown on garden soil (manured with leaf mould) [illegible] May. In eight days 13 germinated, of which two subsequently died, and the remaining 11 plants throve well considering the extreme dryness of the season: seeds were sown six feet apart, the plants rapidly spread; and the Superintendent has no doubt that had the season been a usual one, they would have covered the intervening space. Two of the plants were given to cattle which eagerly ate it, the rest were kept for seed. In December the plants were 5½ feet high, when flowers appeared at the crown. Seed-cobs similar to those of maize formed themselves, but unlike the Indian corn it had a cob on every joint of the stalk. The plant being an annual, the Superintendent recommends that two or three stalks in each stool be left for seed, the rest being cut for fodder as often as they should become fit for the purpose, and that when in seed, they should be carefully tended as the birds are very partial to it. Here also self-sown seeds have germinated, and if these thrive it will be proved that the plant is capable of reproducing itself.

Allahabad.—Twenty-three seeds were sent to this farm, twelve of which were sown on the vegetable ground in the Khasru Bagh on 6th July, five feet apart each way. Nine germinated about the sixth day after sowing; but owing to the very unfavorable dry weather prevalent at the time and some field-rats which got into the ground, only three remained alive, which were watered ten times during the season. On 27th November these three plants attained a height of 12 feet and tillered well, some of them having as many as 42 stems. They were then cut and produced ¼lb. of seed and 120lbs. of fodder.

On 10h August the Superintendent sowed the remaining eleven seeds as above, of which five germinated. The plants grew away very strong, were kept weeded and watered four times during the season. They grew to a height of 7 feet and also tillered well, one of them showing 47 stems. These plants were cut on 28th December and produced 1¼lbs. of seed, and 100lbs. of fodder. The Superintendent remarks:—"It will thus be seen that the late sown plants produced the greatest quantity of seed, and the first sown the greatest quantity of fodder. Owing to the dry season, however, the experiment was not at all conclusive; but having sufficient seed now on hand I purpose sowing one acre this season, side by side with *sorghum*, which is our heaviest fodder-producing crop. This will enable us to test exactly its capabilities as a fodder crop against the *sorghum*. I have already sown in February a small quantity of both seeds, i. e., *Reana luxurians* and *sorghum*, to determine which of them is the most suitable as a fodder crop, during the hot weather months where food for cattle is so scarce."

A packet of seed received from the Government of India has been forwarded to this Department with G. O. endorsement No. 616A dated the 7th March last. This seed has been kept for sowing on the banks of the canal Rajbahas near Cawnpore. A report on the results will be submitted to Government in due course.

WHEAT CULTIVATION IN MADRAS AND IN AUSTRALIA.

We gather from some official reports received from the local Government, that wheat cultivation is very limited in this Presidency, the area devoted to this crop being about 23,000 acres out of a total cultivated area of upwards of 22 millions of acres. The cultivation is chiefly carried on in Kurnool, Bellary, Nilgiris, Coimbatore, Cuddapah, and Kistna. The outturn of crop per acre reported by Collectors varies very considerably for the different districts. It is highest in Cuddapah, 750lbs., 600lbs. in Nilgiris, from 600 to 135lbs. in Kurnool, 516lbs. in Coimbatore, and 193lbs. in Bellary. Black cotton, dark loam, and alluvial soils are generally considered suitable for wheat. The mode of cultivation of this crop does not differ materially from that of other grains. It is chiefly grown on dry lands, although irrigation is occasionally resorted to. Land is ploughed and manured in the usual way, and the seed is either drilled in or sown broadcast. After the plants have sprouted and grown to some height, the ground is harrowed once and the crop is weeded, twice or thrice. The quantity of seed sown per acre is variously given in the different districts. In Cuddapah it varies from 12lbs., to 72lbs., in Bellary from 10 to 20lbs., in Kurnool from 22 to 48lbs., in Coimbatore from 14½ to 40lbs., and in the Nilgiris it is given as 42lbs., Wheat is generally raised under the north-east monsoon. It is sown in the months of October and November, and reaped in January and February, excepting in parts of Coimbatore, where it is sown as early as April and May, and reaped in September or October. The wheat grown in this Presidency is generally of an inferior description. The average wholesale prices of wheat per cwt. reported by collectors are as follows:—

	Rs.	A.	P.	
Kistna	5	4	0	per cwt.
Cuddapah	4	5	7	"
Bellary...between	3	12	0	2-12-10 per cwt.
Kurnool	4	13	8	per cwt.
Coimbatore	3	0	0	"
Nilgiris	5	13	4	"
Godavery	4	5	0	"

Wheat is consumed in small quantities by the higher classes as a luxury on the occasion of festivities, and is not a staple food. There are no data for making even a rough estimate of the quantity consumed in this Presidency.

There is no reason, however, why this Presidency, like the rest of India, should not produce large quantities of wheat, and every year will now probably witness an increase in the export of this grain to the London market. Wheat, it is important to know, comes under the head of a "dry" grain, which can be grown without artificial irrigation. The conditions under which it is grown in South Australia are well eserving the attention of the Indian Government; the success attending its cultivation in this colony, being one of the marvels of modern agriculture. The total population of the colony at the present time is about 210,000 only; but this population not only grows bread-stuffs enough for its own wants, but exports over 200,000 tons a year to other countries, the bulk of course to England. In other words every individual produces over a ton more food grain than is required for consumption in the colony; and this too irrespective of the large production of wool and copper by the same population. In the ten years from 1866 to 1875, the exports of bread-stuffs from South Australia were as follows: flour 440,989 tons, value of £5,698,081; wheat 2,270,909 quarters, value of £4,466,549; bran and pollard 28,121 tons, value £146,797. And yet about thirty years ago flour had to be imported at Adelaide, and was worth £100 a ton! The following extract from Mr. John Harcus' recent work on South Australia, gives us some interesting particulars of the history of wheat cultivation in that colony:—

"When the first colonists arrived, the country was parched up, the ground hard-baked and apparently unworkable. For some time the early settlers were content to sit down with the conviction that agriculture on such a soil, and with such a climate, was impossible. A great deal of suffering resulted from this false inference. The most important of all the necessaries of life had to be imported at a ruinous cost from Tasmania; and flour was actually sold in Adelaide at £100 per ton. Some daring colonists, however, thought they would honestly try whether wheat could not be produced on the Adelaide plains. The land was tilled, the seed deposited, and the result anxiously looked for. Happily, wheat growing became a success from the beginning. Writing as I do now, when the result of the last harvest enabled us to export something like 180,000 tons of bread-stuffs, after supplying our own wants, it seems almost absurd to think that the early fathers and founders of the colony should even have entertained a doubt as to the productiveness of the soil and climate. For a long time, agriculture was confined within a radius of say, twenty miles of Adelaide, and persons 'who ought to know' gravely asserted that beyond that radius agriculture was impossible. These persons however, proved to be false prophets. During the last harvest, country 150 miles and more to the north of the metropolis has, without the cultivation necessary in England, produced splendid wheat, averaging from fifteen to eighteen bushels to the acre."

The chief peculiarity in the climate of the South Australian wheat plains is a "dry heat." During the summer months, from December to March, the heat is sometimes intense, the thermometer registering from 105° to 110° in the shade. The average rainfall at Adelaide is about 21 inches, falling principally between May and October, on about 110 days (in England the average is 24 inches) And yet the Australian climate is described as "capricious" for wheat. The plagues with which farmers have to contend are drought, red-rust, "take all" and, sometimes locusts. The cost of cultivating wheat in South Australia is very small compared with that in other countries. Any thing like scientific farming is rarely if ever attempted in the colony. Mr. Harcus writes: "Tickle the land with a hoe, and it laughs with harvest," is almost literally true here. Virgin soil is ploughed up three or four inches deep, and often without even fallowing it the seed is thrown in, and should the season be moderately favorable, a fair crop rewards the small labour of the husbandman. This goes on from year to year: any thing like a rotation of crops is never attempted. There are farms in South Australia, which have been annually cropped with wheat for twenty or twenty-five years, and yet last harvest they produced as abundantly as ever." Nothing could enable the South Australian farmer to thrive with his comparatively small average per acre, and the low price at which he is compelled to sell, but the cheapness of production. The expense of the cultivation is small, and the gathering in of the crop when it is fully ripe costs a mere trifle, thanks to Ridley's reaping machine, "which reaps and thrashes the wheat by one simple process." A machine of this kind can only be used where the climate is dry, and where the grain is allowed to ripen and harden in the ear. This machine merely clips off the ears of the wheat, and leaves the straw standing in the ground, where it can be burnt, and thus serve as manure. Indeed the cost of wheat farming in South Australia has been reduced to a minimum.

On the whole, comparing the climate, soil, and system of agriculture in South Australia with those of India, there is a reason to anticipate that a great and profitable industry is open to the people of this country in the direction of wheat cultivation. With her cheap and abundant labour, India should have a great advantage over both America and Australia, while the freight on corn shipped from India to the London market should certainly be lower than it is from Australia. We notice from the Madras returns that the yield of wheat per acre in this Presidency is about 12 bushels in Cuddapah and on the Nilgiris, the wholesale price being about five shillings per bushel. This is quite equal to the average production in South Australia, where wheat has averaged that price during the last ten years. The question, therefore, arises whether wheat could not be grown as profitably here as on the Adelaide plains. We see that the Collector of the Kistna District doubts whether ryots should be advised to turn their attention to wheat, on the ground that the Indian wheat "is a stunted miserable looking crop, and the grain is about half the size of that grown in England." We have heard Mark Lane merchants express very different opinions of the quality of Indian wheat, which is yearly becoming more appreciated in the home markets. It is possible the Kistna ryots have not had good seed for purposes of cultivation. The Collector of this district will pardon us, perhaps, for reminding him of what has been done in South Australia. The agricultural condition of that colony is thus pithily summarised: 50,000 men supporting thrice their number of women and children, occupy 200,000 square miles of pastoral country, and possess 6,000,000 of sheep; own 6,000,000 acres of land, and grow 12,000,000 bushels of wheat; conduct an external commerce of £9,000,000 sterling, and raise £1,000,000 of revenue. It might be worth while for the Government of India to study how these splendid results have been achieved.—*Madras Mail.*

THE BEET-SUGAR INDUSTRY OF FRANCE.

In 1824 France produced a total of 15,000 tons of beet-sugar, in over 100 factories. In 1837, the product was 49,000 tons. France, since that time, has doubled the product of beet-sugar every ten years. In 1820, the product was only two pounds for each inhabitant; in 1865, it was fourteen pounds per capita. Since 1865, except in the immediate vicinity of the seaboard, no sugar is seen or used in France except the beet-sugar. The same is true of Germany. This is almost the only sugar used in Paris, Vienna, Berlin, Dresden, Leipsic, or Munich. In 1837, the yield of beets per acre was twelve tons, price 3 dollars per ton. In 1865, the yield was sixteen tons per acre; price three dollars and twenty five cents. The percentage of sugar contained in the beets in 1837, was 10 per cent.; in 1865, 11½ per cent. The cost in 1837 was seven cents per pound; in 1865, it was reduced to four cents per pound. Thus, it has required nearly a half century to establish this great and valuable industry on the Continent of Europe, on such a basis as to defy competition, and we now have the benefit of their experience. It has been the result of careful and continued attention to thus increase the product, as well as the percentage of sugar in the beet, and this by studying carefully its natural laws, and by the application of chemical knowledge and mechanical ingenuity to extract the sweet therefrom, to purify it, and render it suitable for the most fastidious tastes. This sketch, while, relating mainly to France, applies also to the rest of Continental Europe; France only led in the race. Such is a brief history of the growth of the industry up to 1865, and since that time its continued success is shown by the following statistics: Total product of beet-sugar in 1853, 200,000 tons; total product of beet-sugar in 1863, 452,000 tons; total product of beet-sugar in 1873, 952,000 tons. It may be considered as one of the established industries of the temperate zone, and only awaits the judicious application of capital and labor to establish it on any suitable soil, and in any proper locality. The permanent effects produced on agriculture in France by the cultivation of beet-sugar have been astonishing. In the cane-sugar districts, no other crop is to be seen, while cattle sheep, and hogs are few. In the beet-sugar districts of Central Europe, on the contrary, the fields are crowded with the greatest diversity of crops, such as beets, wheat, rye, oats, barley, etc., as well as all of the cultivated grasses. No farmer there need to be told which system is the most enduring. On a great public occasion the following significant inscription was placed on a triumphal arch: "Before the manufacture of beet-sugar, the arrondissement of Valenciennes produced 695,590 bushels of wheat, and fattened 700 oxen. Since the manufacture of beet-sugar was introduced, the arrondissement of Valenciennes has produced 1,157,750 bushels of wheat, and has fattened 11,500 oxen." A farm of 832 acres in France, the product of which with the ordinary farming, amounted to 8,000 dollars per annum, with six years of beet-sugar cultivation, produced 41,200 dollars per annum. Another farm, of 295 acres, produced 5,225 bushels of wheat, 2,500 tons of beets, and fattened 150 head of cattle, per annum. The farmers attributed their success as cultivators entirely to the immense amount of barn-yard manure which the beet-pulp gives to the stock, enabling them also to effect an improved condition of the so[illegible] The improved and increased amount of profitable culture of the land consequent upon beet-culture is now universally acknowledged, and wherever the beet is cultivated, lands advance in value, and wages take the same direction. Cows fatten upon the leaves and pulp, and also produce more and better flavored butter and milk than when fed on grasses; so that the production of sugar from the beet adds to the supply of bread, butter, and meat; and these—the leading necessities of man's existence—stimulate and aid each other.

The varieties of sugar-beet most extensively used are the White Sugar, or Silesian, the Imperial, and the Quidlingburger, and they penetrate the soil from eight to twelve inches. The most desirable weight is from 1½ to 4 pounds each. Their greatest diameter is from three to six inches. Large or overgrown beets are very poor for sugar. If the soil is cultivated to a suitable depth, the beet-root will grow entirely beneath the surface; but when the ordinary cultivation is used, being unable to attain its length below the surface, it will extend above the ground: where, exposed to the sun's rays, it is injured, and less productive. Any soil that is suitable for wheat, which has been under cultivation—the longer the better—that admits of deep tillage, clear of stones, with a clay tendency, is suitable for beets.

A SUBSTITUTE FOR INDIGO.

A RECENT triumph of chemical science is announced which may have some influence upon the indigo-planting industry, in which so many in India are interested. This is no less than the discovery by Professor A. Baezer of Munich (Liebig's successor) that the colour of indigo can be produced artificially by chemical processes. From a chemical point of view this is a very great triumph, since, hitherto, only one vegetable colouring substance has been artificially prepared, and the many researches made by chemists on other colouring matters have ended in failure. Indigo-planters, may be excused if they regard this chemical triumph with some anxiety especially when we consider the history of the artificial production of the colouring matters formerly derived from madder. It is only ten years since two German chemists first succeeded in forming from anthracene, itself derived from coal tar—the colouring matter known as alizarin, which up to that time had been got from madder, the root of a plant (*Rubia tinctorum*) much cultivated in the south of France and the Levant. It is from alizarin that we derive our most brilliant and permanent red dye for stuffs, of which the most important is Turkey red. The artificially prepared alizarin was in every respect similar to that obtained from madder, but the process by which it was first prepared was too costly to permit of its being manufactured on a large scale. Before long, however, a much cheaper process was discovered; and now, so largely has its manufacture developed, that it seems probable that before long the production of this dye from natural sources will have entirely ceased. As to indigo the process of manufacturing it artificially is at present both complicated, and expensive. but Professor Baezer, who has already spent some twenty years on his researches in this direction, is not likely to leave his discovery where it now stands, and, at the same time, other chemists may rush in and try to make conquests in the same field. So, while we do not think that indigo planters have any immediate cause for alarm, they should very carefully watch the progress of the investigations on this subject, and be prepared to meet any danger that may threaten them, by such improved method of cultivation, and preparation, as may render it more difficult for manufacturers to compete with them. Perhaps our readers will expect us to give some account of the processes employed by Prof. Baezer alas! We fear it would be impossible to render them intelligible to the general reader. But we may mention that the following are some of the steps. *Phenylacetic acid* is changed into *ortho-nitrophenylacetic acid*, and that into *ortho-amidophenylacetic acid*, from which finally is derived *isatin*, and from that indigo blue!

INTERNATIONAL EXHIBITION AT SYDNEY.

AN International Exhibition is to be held at Sydney, New South Wales, in August 1879. The New South Walse, *Government Gazette*, gives the information that it is to be held in buildings specially erected in the Prince Alfred Park, Sydney. All goods forwarded for exhibition and addressed to the Secretary for that special purpose, will be admitted free of duty or customs charges.

The exhibitional will be divided into two distinct divisions as under:—

1st Division—Agricultural.

1. Horses.
2. Cattle.
3. Sheep.
4. Pigs.
5. Poultry.
6. Dogs.
7. Wool.
8. Wine.
9. Sugar.
10. Farm Produce.
11. Horticultural Produce.
12. Manures.
13. Implements and Machinery.
14. Silks, Fabrics and Tobaccos.

2nd Division—Non-Agricultural.

1. Fine Arts.
2. Apparatus and other applications of the Liberal Arts.
3. Furniture and other objects for the use of dwellings.
4. Clothing, including fabrics and other objects worn on the person.
5. Products of Mining Industry, Forestry, &c.
6. Apparatus and processes used in the Common Arts.
7. Food—Fresh, preserved, and in various states of preparation.
8. Artizans' prizes (including all new inventions).
9. Public and Denominational School Prizes.

The Society provides yards, sheds and stalls, &c., for animals, and stands, &c., for other exhibits of which it undertakes the care and charge, without, however, incurring any responsibility.

In the agricultural department money prizes are awarded as well as printed certificates, in the non-agricultural [illegible] silver and bronze medals, also certificates of commendation. [illegible] exhibits sent may be sold at the exhibition, but must remain until the final closing. Application for space to be made at least one month prior to the date of opening, and all information respecting the exhibition may be obtained from the Secretary, M. Jules Joubert, [illegible], George-street Sydney, New South Wales.

ON THE PARA AND CEARA RUBBERS, AND BALSAM OF COPAIBA TREES.

A REPORT on the subject of India rubber yielding plants in their own native homes, and comprising also an account of the collecting of balsam of copaiba has recently been issued from the India-office. It has been furnished to the Secretary of State for India, by Mr. Robert Cross, who is well-known for his labours in the cinchona forests of South America, and the subsequent introduction of the plants into India, since when Mr. Cross has made more than one trip to South America for the purpose of securing seeds or plants, of both of the best rubber producing trees, and the results of his more recent expedition for this purpose is embodied in the report before alluded to. Mr. Cross gives a brief account of the habits of the Para people, which place he reached on the 15th July 1876. The popolation it seems is about 40,000, most of whom engage in some way with the despatch of import and export produce. Notwithstanding the reputed fertility of the Amazon valley, nearly all the necessaries of life are imported, butter and fish from Norway, rice and flour from the United States while sugar, coffee, and mandiocca come from the southern parts of Brazil. The great bulk of the citizens are described as going about more ostentatiously dressed than the people of London; the essential costume being a fine black coat and hat, snow-white west and trowsers, and fancy French boots. 'Water is supplied to the city by being carted through it in barrels, and sold at the rate of three-half pence for about 21 English pints. Dysentery, yellow fever, and various other forms of fever are said to be prevalent, and altogether Para is considered to be more unhealthy than any city in India. The province of Para, and the islands that are scattered over the lower portion of the Amazon, are described as the great field for caoutchouc collecting. A good deal of the rubber from the Rio Negro, Madeira, and other tributaries, seems to come in the form of Negro-head or sernamby, while that from the Para region is the finer kind of smoked biscuit rubber, to the preparation of which greater care is given. It is indeed reported that the Para tree is a different variety, its milk leaves no very prominent stain on the hands or clothing, while the milk of some of the varieties of rubber of the upper Amazon gives a black ink-like mark to the hands and clothes of collectors. When once in the country, how Mr. Cross started on his mission will be best described in his own words. He says:—"In order to form and establish a collection of plants, and for the purpose of making the various observations on the soil, climate, and mode of collecting and preparing the rubber, it was necessary to obtain a place to live in while so employed. Every one told me, I would experience great difficulty in finding a dwelling, and this proved true. After travelling round Para and searching for about eight days I succeeded in hiring a house, but at a very high rate, as the place was large, and adapted for a family with attendants and slaves. However, it was secure and offered every facility for my various requirements, which was important. My next work was to examine the district where the rubber trees grew, and on the 25th July, I made a preliminary journey to the region where the trees were wought." Leaving Para, the high ground was traversed for several miles until the primitive forest was reached, a path used by caoutchouc collectors through the wood. The traveller soon came upon a large tree in a state of decay, which had been tapped many times. From the ground up to a height of 10 or 12 feet the trunk was one swollen mass of warty protuberances and knots, covered with thick scales and hard, dry bark. This singular form of growth—the result of the practised system of tapping—has never previously been recorded. A few minutes of careful examination soon showed the real cause of those deformities. The collector uses a small axe-like instrument, an inch broad; at each stroke he cuts through the bark and into the wood for fully an inch. Hundreds of these are made in the trunk of each tree in the course of a few years, and cannot heal under any circumstances; but a layer of wood is formed over the injured part, at the expense of the bark and general vitality of the tree. The newly formed wood is again cut into and splintered, and so the process is repeated on each successive layer, until the trunk becomes merely a mass of twisted wrinkled wood, with very thin insipid bark. In this condition hardly any milk flows from the cuts, and, although for years a few green leaves may continue to sprout from the points of the twigs, yet the tree may be considered as dead, and, in fact, finally withers away. It is, therefore, the injury done to the wood, and not overtapping, which lessens the flow of milk, and ultimately causes the death of the tree. The cuts in the wood are of course unnecessary, since the milk is met with only in the bark. The healing-over process which afterwards takes place is similar to that seen where a branch has been lopped from a trunk. The wood is compact and rather hard, and for this reason the tree lives on for a number of years, although cut and hacked every season; but the flow of milk becomes so lessened that many are practically abandoned for years before they die. This and several large adjoining trees were growing in moist, deep, heavy soil, of a fertile character, but quite out of the reach of any inundation.

On the margins of both the larger and smaller streams a considerable number of rubber trees were found, mixed with cacao and forest trees. Three were observed, the bases of the trunks of which were flooded to a height of one foot, yet the roots seemed to run up to the brow of the bank, and no matted roots were observed, as is the case with the willow tree when growing on the margin of a rivulet. Most of the others occupied dry situations

A number of good plants were met with beneath the oldest trees At places where the ground was covered by more than two or three inches of water at flood tide, seedlings did not usually grow. By far the greatest number, however, were met with in situations above the reach of the highest tides. A few of the largest trees were measured, all of which had been tapped for periods varying from five to fifteen years. Most of the trees occurring within the limits of the worked districts are tapped if possessing a diameter of six or eight inches. Regularly tapped trees, as a rule, do not exceed 60 feet in height.

Mr. Cross relates some rough and ready experiments made by him with a view of proving the conditions under which the Para rubber plants may be best propagated. These experiments were conducted while the plants which he had previously collected, 2,000 in all, were being established in three cases. He says they were commenced "in order to ascertain how the tree might be readily multiplied in a rough way by any person not specially acquainted with the principles of propagation. Two separate beds, the one of brown and the other of decayed leaves, were formed The terminal portion of shoots, but with a bud at the lower end, were planted in the beds in a reclining position with only two inches of the points above ground. Owing to the great distance between the buds, consequent on vigorous growth, many of the cuttings were a foot or more in length. At the same time a number were set deeply in an open vessel containing only rain water. The cuttings in the sand bed were the first to grow, and soon made strong shoots and root fibres. Those in the leaf mould pushed more slowly, but developed green leaflets of great substance. The cuttings placed in the water had a small portion of tap-root at the base, as the object was to determine if the roots actually develop in water alone. Within fourteen days these plants had several roots formed, and one or two rather weak growths came up, but a few days after I had thrown into the water some burnt earth and wood ashes the increase in vigour was very apparent. After these experiences I felt convinced that the Para rubber tree delights in abundance of moisture and rich fertile deposits." Mr. Cross gives a very detailed description of the tapping of trees, the collection of the milk and method of preparing the rubber, all facts of great interest, and the more so because information of this kind is not readily procurable in a collected form, being for the most part distributed in various books of travel. On this account Mr. Cross's report should be widely circulated. The fact remains, however, that these reports are not sufficiently known amongst commercial and scientific men, and consequently, the wider diffusion of the heads of Mr. Cross's experience is, perhaps, justified in the columns of this *Journal*. The caoutchouc collectors commence work as soon as daybreak, or as soon as they can see to move about among the trees. They say that the milk flows more freely, or in larger quantities, in the early morning, but little importance is attached to this statement the most probable reason for the early tapping is that, rain often falls about two or three o'clock in the afternoon, it is necessary that the work should be done early, as, in the event of a shower, the milk would be spattered about and lost. The collector first of all, at the beginning of the dry season, goes round and lays down at the base of each tree a number of small cups of burnt clay. At the lesser trees only three or four are put, but at the larger one from eight to twelve. The footpaths leading from tree to tree are likewise cleared of sapling growths. On proceeding to his work, the collector takes with him a small axe, for tapping, and a wicker basket, containing a good-sized ball of well-wrought clay. He usually has, likewise, a bag for the waste choppings of rubbers and for what may adhere to the bottoms of the cups. These promiscuous gatherings are termed "sernamby," and from the "negro head" of the English market. The cups are sometimes round, but are more often flat or slightly concave on one side, so that, with a small portion of clay, they may be easily struck against the trunk of the tree. The contents of 15 make one English imperial pint. When the collector arrives at a tree, he strikes with his axe in an upward direction as high as he can reach, making a step upward, sloping cut across the trunk, which penetrates the bark and an inch or more into the wood, and is often fully an inch in breadth. Frequently, a small portion of bark breaks off the upper side, and, occasionally, a thin splinter of wood is raised. A cup is next quickly fixed with clay against the trunk, just beneath the cut. The milk, which is of dazzling whiteness, now begins to exude. At a distance of 4in. or 5 in., but at the same height, another cup is similarly fixed, and then another, until a row of cups encircle the trunk at a height of about 6 ft, from the ground. Tree after tree is treated in this manner until the day's tapping is finished. The earlier the gashing of the trees and the fixing of the cups is done the better, for the milk often continues to exude slowly for three or more hours. The collectors vary very much in the tact and ability shown in the performance of their duties. Some take care to get good clay previously, and to incorporate it well, so that a very small portion is needed to fix the cups to the trunks; they also work with neatness and intelligence and invariably collect large quantities of milk. On the other hand, there are some who exercise no forethought in the preparation of their clay, merely scraping up a handful when they need it. This class, of collector, often have many fragments of clay and other impurities in their rubber. The quantity of milk that flows from each cut varies. If the tree is large and has not previously been twice tapped, the cups will for the most part be more than half full, and occasionally a few may be quite full, but if the tree is much gnarled from tapping, whether it grows in the rich sludge, by streams, or on dry soil, many of the cups will be found to contain only about a table-spoonful of milk, and sometimes scarcely that. On each succeeding day a similar operation is carried on, with the exception that the cups are placed from six to eight inches lower down, until the ground is reached. The collector thus begins as high as he can reach, and descends as before, taking care however, to make his cuts in distinct places from those previously made. When the produce of milk diminishes in long wrought trees two or three cups are put on various parts of the trunk where the bark is thickest. Although many trees are large, the quantity of milk obtained is surprisingly small. This has been described as the result of over-tapping, but Mr. Cross thinks, it is not possible to over-tap a rubber tree, if in the operation the wood is not left bare or injured, but the collector's axe always enters the wood and the energies of the trees are required to form new layers to cover those numerous wounds. The best milk-yielding tree examined had the marks of twelve rows of cups, all the work of one season. The rows were only six inches apart, and in each row there were six cups, so that the total number of cuts made within the period of three months numbered seventy-two. Though this tree grew in a favourable situation and was in every respect a healthy tree, it is considered that with about two years of such treatment it would in all probability become permanently injured. There seems to be no appreciable difference in the quality of the rubber, whether collected in the dry or in the rainy season. It may be, however, that in the wet season a larger proportion of water is contained in the caoutchouc, while on the other hand a larger quantity of milk flows. The dry season is, in fact, the most suitable for caoutchouc collecting.

Two other methods of tapping, which are chiefly confined to the Upper Amazon and its tributaries are described, the principles of which are similar to those already explained.

With regard to the collection of the milk from the cups when full, it is done by a man running from tree to tree with a large calabash, into which the contents of the cups are emptied. As he pours the milk out of each cup he draws his thumb, or forefinger over the bottom to clean out some which would otherwise adhere, a small quantity, in fact does remain, which is afterwards pulled off and classed as sernamby. The cups, after being emptied, are laid in little heaps at the base of each tree, to be ready for use next morning. The time lost in traversing the intricate muddy footpaths beneath the trees is a serious obstacle to expeditious collecting. More than twice the quantity of caoutchouc might be collected in a fourth of the time, and at far less cost and labour, were plantations properly formed

To prepare the rubber, the milk is put into a large flat earthen vessel, beside this are placed narrow necked jars about 18 inches high, and about 12 inches across the broader part; the bottoms are knocked out of these jars, they are raised from the ground on three small stones, fires are lighted in these bottomless jars, and the slight distance they are raised from the ground causes sufficient draft to promote their burning, the fires are fed by dropping pieces of wood and a handful of palm nuts alternately into the mouths of the jars the aim being to cause a dense smoke to arise from the mouth of the jar The mould on which the rubber is prepared resembles the paddle of a canoe; in fact, at many places on the Amazon, this is the article most frequently used, if there is much milk, and when the rubber is prepared in bulky masses, a little soft clay is rubbed over the mould to prevent the rubber adhering, and it is afterwards well warmed in the smoke. The operator holds the mould with one hand, while with the other he takes a small cup and pours two or three cups of milk over it He turns it on edge for a few moments above the dish until the drops fall, then quickly places the flat side two inches above the jar's mouths, and moves it swiftly round so that the current of smoke may be equally distributed The opposite side of the mould is treated in the same way. The coating of milk upon being held over the smoke immediately assumes a yellowish tinge, and although it appears to be firm, on being touched is found to be soft and juicy, like newly curdled cheese, and throwing off water profusely. When layer after layer has been repeated, and the mass is of sufficient thickness, it is laid down on a board to solidify, and in the morning is cut open along the edge on one side and the mould taken out. Biscuit rubber, when fresh, is often four or five inches thick After being hung up to dry for a few days it is ready for market The fact of burning palm seeds (which are said to be those of *Euterpe edulis* and a species of *Attalea*) has given rise to an opinion always stated by travellers that the smoke produced by these burning nuts exercises some peculiar effect upon the milk by which it coagulates almost instantly. After a careful examination of this matter, Mr. Cross expresses it as his conviction that the rapid coagulation of the milk is simply produced by the high temperature of the smoke. and that with a strong current of heated air or a good pressure of steam from a pipe, a similar result would be obtained. He says, "I have no hesitation in giving my opinion that equally as good rubber could be prepared by putting the milk into shallow vessels, and evaporating the watery particles by the heat of boiling water."

With regard to the introduction and propagation of the Para rubber plant into India, the hottest parts and the low-lying, the moist tracts, or land subject to inundations are recommended, deep, humid land suitable for cane and coffee planting is quite suited for the tree. The Malay peninsula, Burma, Ceylon, and Southern India are said to posses many suitable localities. The green terminal shoots of succulent growth, with the leaves fully matured, make the best cuttings. They should be cut off low enough to take in a joint at the base. When planting to in dry firm land, a spadeful of soil should be turned over at each place, and the cutting planted in a sloping position It should be covered with mould to within three inches of the point. That portion above ground should rest on the earth on one side to its termination so as not to suffer through hot sunshine. Seeds may also be planted and the soil much improved by the addition of a handful of wood-ashes with each seed at the time of sowing. In watery places, or in deep mud deposits, seeds are not recommended, as many would mould and rot. Mr. Cross gives a very detailed description of the best modes of propagation, soil, &c., and also his experience in search of the Ceara rubber, about which a good deal of interest has been manifested, the plant producing it, not having been accurately known, but suspected by many writers to be identical with the Para tree. Mr. Cross succeeded in bringing home seeds and plants, and the true Ceara rubber is now proved to be the produce of *Manihot glaziovii*, which, though quite distinct from that of Para, nevertheless belongs to the same natural family—the Euphorbiaceae. The rubber is collected in a different manner to that of Para. The outer surface of the bark of the trunk is pared off to a height of four or five feet, the milk then exudes and trickles down in an irregular manner, falling, for the most part, on to large leaves that are laid about the base of the trunk to receive it; some however, drops on to the ground, and so often gathers up with it dust and loose stones. After several days the juice becomes dry and solid, and is then pulled off and rolled up into balls or put into bags in loose masses. The trees are badly used, the tapping being made too deeply into the wood, so that many trees are in a state of decay. From the fact that Ceara rubber, occupies a good place in the market, being exported at the rate of about 1,000 tons per annum, it is to be hoped that more care may be taken of the trees, and that it may be successfully established in India. Mr Cross suggests that in the districts of Madras, Cochin, Calicut, Cannanore, Mangalore, and Bombay, *many localities possessing all the conditions essential for the growth of Ceara rubber may be found, and the plant might also be tried in the deep tropical valleys of Assam; indeed, in all the parched region of India within the limits of coffee culture.*

On the subject of balsam copaiba, which is yielded by different species of *Capifera*, Mr. Cross describes them as having a wide distribution, being abundant in the forests of Amazon valley, of Guiana and Venezuela, and in the wooded littoral districts of New Grenada, especially in the States of Santa Martha, Carthagena, and Panama. The finest sort known in commerce, and called by the collectors white copaiba, is met with in the province of Para, and is shipped from Para and Maranham. Very large quantities are annually sent to the French market. Formerly the trees might be seen growing within easy access; but, owing to the method of collection practised, it is now comparatively rare. At present a collector must make a journey of several weeks in a canoe up some of the Amazon tributaries, or penetrate into the dense forest lying between the rivers, to find any considerable quantity of copaiba. The life of a balsam collector is said to be one of the most wretched description, as he is exposed daily to the drenching rains in the depths of the forest, with often an insufficiency of food, constantly bitten by large formidable ants, and tormented unceasingly by day and night by swarms of mosquitoes. As if to make amends for all these miseries, a collector can earn, when the trees are abundant, as much as £5 per day. *The trees grow to a great height, running up to 50 ft. or 60 ft. before branching,* but no seedlings, or young plants, are to be found in the forests, for so soon as the seeds fall, they are greedily devoured by a small, animal about the size of a rat. To collect the balsam a hole or chamber about a foot square, is cut in the trunk, at about 2 feet from the ground. The wood is white to a depth of 4 or 5 inches after which it is of a purplish red colour; indeed, the woods of all the species of copaiba have this peculiar tint. When the centre of the tree is reached by the adze, the balsam flows out in a current full of hundreds of little white pearly bubbles. "At times the flow stopped for several minutes, when a singular gurgling noise was heard after which followed a rush of balsam. When coming most abundantly, a pint jug would have been filled in the space of one minute." From the fact that every chip cut out was studded with drops of balsam, it seems conclusive that every particle of the wood is highly charged with it, though the bark appears to possess none. A large tree in good condition, is estimated to yield about 84 English imperial pints. Mr. Cross refutes the stories told by travellers that the balsam is collected by gashing the bark and plugging the space with cotton to absorb the juice which exudes of the closing cavities, made in the trunk, with clay or wax, to allow the balsam to accumulate, and then opening them and extracting the collected balsam. Both systems, he considers, would be practically useless. Little or no care seems to be taken to preserve the balsam pure. Old jars and barrels, that have previously contained grease or liquors of all description and old paraffin cans, are very much sought after, and are used without being properly cleaned.

This valuable tree, those yielding India-rubber, has been [illegible] posed for introduction to India. The temperature required for it is similar to that required for the Para rubber tree. Wet or moist land should be avoided and the plants should be put in the best dry loam such as is suitable for cane or coffee planting; seedings may be planted tolerably thick so as to shoot up rapidly, when they could be thinned out to proper distances. Mr. Cross concludes his remarks on this interesting tree in the following words:—"I would not recommend the planting of these on a large scale with a view to early profit, as the growth would be slower than Panama or Para rubber trees. The return would, I think be realised in about the same time as is the case with oak plantations. However, a few hundred of copaiba trees growing on a planter's estate ought to enhance the value of it. Apart from the medicinal value of copaiba, it might be well to ascertain if it would not be equal to castor oil for lubricating machinery."

KANS GRASS IN THE BANDA DISTRICT.

Dated Banda, the 26th June, 1878.

From.—M. A. McCONAGHEY, ESQ. *Officiating Collector of Banda,*

To—The Commissioner, Allahabad Division.

SIR,—I have the honour to submit my notes on the result of experiments, made during the past year in the cultivation of land covered with kans grass. The season was very unfavourable, on the whole, but, except in the case of Kanwara and Gorey, the cost of production has nowhere exceeded the value of the outturn. In Gorey the failure arose from the stupidity of the officer to whom the experiments were entrusted, and in Kanwara, owing to the sandy character of the soil, it was impossible to expect much from it in a year like 1878.

2. Owing to the almost total failure of the rains up to the beginning of October, 1877, the growth of kans in this district has received a decided check, which I trust will be taken advantage of by the zemindars and cultivators this year, provided there is a sufficient rainfall to encourage extension of cultivation. The extension of cultivation I will do all in my power to encourage, by liberally granting takávi advances to those who require help.

3. Kans must and will succumb to labour, and to labour alone can we look for its permanent eradication. The experiments in Pachnehi, I hope to carry on, on even a larger scale this year. An extract from my report No. 550 of 26th April, 1878, on the state of the gram crop is annexed.

I have, &c.,
M. A. McCONAGHEY,
Officiating Collector.

Result of experiments on the cultivation of kāns.

1.—*Bhawanipara*— A suburb of Banda

	B.	B.	B.	
Area	2	9	7	Soil a light 2nd class [illegible] overrun with kāns for nine or ten years when taken up in 1876

In 1876, ploughed six times weeded twice, and then so [illegible] under the same conditions.

This year ploughed three times (*viz.*, twice with a native plough and once with an English plough) and then sown to gram:—

	1876.		1877.		1878.	
Produce—	M.	S.	M.	S.	M.	S.
Gram	3	15	4	30	5	7½
Bhusa	2	20	4	20	5	10
Outturn per bigha ...	1	18	1	37	2	4

	1876.			1877.			1878.		
	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Value of produce ...	3	8	10	5	8	6	17	11	4

Cost of production—

	Rs.	A.	P.		Rs.	A.	P.	
1876 ...	15	6	8	including	8	1	4	rent.
1877 ...	12	7	8	do.	8	1	4	do.
1878 ...	13	0	4	do.	8	1	4	do., includes

a nominal cost of Rs. 3-8-0 estimated hire of four Government bullocks used with the English plough for 3½ days.

Result Very satisfactory considering the season, which was not an average one for gram, (see extract from report annexed).

Produce greater than last year, and outturn five times the quantity of seed sown, cost of production slightly higher, owing principally to the dearness of gram at seed time.

	Rs.	A.	P.
Cost of cultivation including rent and seed ...	13	9	4
Value of produce	17	11	4
Net profits	4	2	0

Rs. 3-8-0 besides in hand (see above.)

The field is now in as good condition as those in the neighbourhood, which have been under cultivation for many years. Kans has not been altogether eradicated, but it is *gradually* dying out.

II.—Mawai Buzurg, a short distance from Banda on the Fatehpore road.

Area of field, 1 bigha, 12 biswas, 16 biswansis, soil *parua* has been under kans for 11 years. Kans not so strong as last year.

In 1876, ploughed six times, weeded twice and then sown to gram.

Last year ploughed five times after Rs. 2-13-0 had been spent on cutting the kans.

This year ploughed four times with a country plough and sown to gram.

	1876.		1877.		1878.	
Produce—	M.	S.	M.	S.	M.	S.
Gram	2	16	4	35	3	0
Bhusa	2	5	4	21	2	36

	1876.		1877.		1878.	
	M.	S.	M.	S.	M.	S.
Outturn of gram per bigha	1	18	2	39	1	33

	1876.			1877.			1878.		
	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Value of produce ...	2	10	8	4	10	0	10	3	2

Cost of production—

	Rs.	A.	P.		Rs.	A.	P.	
1876.	8	12	9	including	0	9	9	rent.
1877	12	4	7	do.	2	9	9	do.
1878.	10	4	8	do.	2	9	9	do.
Cost of cultivation ...	10	4	3					
Value of produce	10	3	2					

Result.—Gram in all light soils failed this year. I consider myself very lucky in not having lost pecuniarily on this field.

III.—Hardauli, close to Cantonment.

	B.	b.	bis.	
Area of field	2	4	17	Soil kabar.
"	0	15	0	Newly broken up this year by English plough. Soil kabar.
Total .. .	2	19	17	

This field, until last year, had been fallow for upwards of ten years. In October, 1876, the kans which was very strong, was cut down and 2 bighas, 4 biswas, 17 biswansis ploughed six times with a native plough.

	1877.			1878.		
Produce—	M.	S.	C.	M.	S.	C.
Gram	4	25	0	6	30	0
Bhúsa	3	15	0	6	14	0
Outturn of gram per bigha ...	2	2	7	2	10	3

	1877.			1878.		
	Rs.	A.	P.	Rs.	A.	P.
Value of produce ..	5	4	0	22	13	6

Cost of production—

	Rs.	A.	P.	
1877	8	4	4	(rent 9 annas)
1878	*14	8	0	(rent 12 annas.)

	Rs.	A.	P.
Cost of cultivation	14	8	0
Value of produce	22	13	6
Giving a clear profit of ... ... Rs.	8	5	6

After allowing Rs. 4 for Government bullocks.

REMARKS.—A very successful experiment, considering the badness of the season for gram. The kans is not nearly so strong as it was last year. This however is general. The field looked better cultivated than its neighbours.

IV.—Gorey, about four miles from Banda.

The experiments in four bighas of hard már soil in this village failed, owing to the carelessness and stupidity of the naib tahsildar and a chaprassi, to whom the carrying out of orders was entrusted. Here we have experienced a loss of Rs. 5-5-6, which the naib tahsildar must make good. Giving statistics would only mislead.

V.—Kanwara, on the banks of river Ken, two miles from Banda.

Area 4 bighas, 14 biswas soil light *barua pandua*, which had lain fallow for eight years, owing to kans. Brought under cultivations last September, ploughed three times (once with an English plough and twice with a native plough) and sown to gram.

	M.	S.
Seed sown	2	5
Produce, Gram	1	15
" Bhúsa	1	30

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* This includes Rs. 4 estimated cost of ploughing by Government bullocks and English plough, *viz.*, four bullocks for four days.

Cost of production
Rs. 16-9-2, including Rs. 0-9-5 rent, and Rs. 5 estimated cost for the use of four Government bullocks for five days.

	Rs.	A.	P.
Value of produce	4	13	1
Net loss	11	12	1

Soil very light and bad, hence the crop such as it was, suffered severely from the dry winds of the last two days in February and the first three days in March.

VI.—Pachnehi, (9 miles from Banda) under direct man gement.

The thirty-nine bighas, six biswas, of the worst kans land in the village, and perhaps in the district, which had been fallow for many years, taken in hand. I have never seen kans of stronger or more luxuriant growth anywhere. This plot is in the *har* towards Lama, a village on the Fatehpur road some eight miles out of Banda, and the Senior Member of the Board of Revenue and your two predecessors know it well. Natural soil firm mar.

Eight strong bullocks were purchased by me to work the land and four native ploughs were made. It was found impossible to work an English plough with the bullocks at our command in such hard soil. The kans was first cut down by coolies and burnt on the ground, then the land was ploughed four times and gram sown. Owing to the difficulties experienced in ploughing and getting rid of the kans, it was late in the season before the seed was sown. It germinated well, however, and when Mr. Plowdon and I visited the village, towards the end of December, the young crop, over at least two thirds of the area, promised very fairly. In the beginning of January the munsarim reported that the continuous drought was telling much on the crop, but the heavy rains of the 12th and 13th January resuscitated it wonderfully, and I began to look forward to an outturn of at least two maunds per bigha. The strong west winds which blew almost continuously during the last two days of February and the first few days in March, finally destroyed my hopes. It scorched up the green and succulent plants and prevented the gram which was just forming in the pods from developing, and the result was an outturn of only 23 maunds, 21½ seers of gram instead of 80 maunds, as I anticipated. This has been a great disappointment, but after selling the gram, bhusa and bullocks, I am still able to show a profit of Rs. 50-9-9 on the whole transaction. I have also four ploughs in stock. The bullocks throve very well on the green kans, with an allowance of bhusa and khal, whilst in regular work, and I was able to sell them at Rs. 200, having purchased them at the Bundki fair, some seven months previously for Rs. 109-11-0. The gram and bhusa sold for Rs. 75-1-0. The following are the details of expenditure and receipts :—

Expenditure.—

To purchase of eight bullocks	Rs.	109	11	0
Cost of four ploughs	„	5	6	0
Labourers to attend on the bullocks, bring grass for them, drive the ploughs, and now and then cut down kans	„	62	3	0
Salt for bullocks	„	1	0	9
Bhusa and khal for bullocks	„	11	5	0
Coolies for cutting khans	„	4	7	0
Seed gram	„	30	6	6
Total .. .	„	224	7	3

Receipts.—

To sale of bullocks	Rs.	200	0	0
„ of gram and bhusa	„	75	1	0
Total	„	275	1	0

Profits Rs. 50-9-9 and four ploughs in stock.

It is my intention to experiment on these 40 bighas again this year. Bullocks I will either hire or borrow from the Municipality, paying fair rates for their use

Extract from Report No. 530 of the 26th April, 1878, on the state of the gram crop.

This crop, which at one time (about the middle of February) promised to equal that of last year in luxuriance and yield, has disappointed the expectations held of it considerably. The late gram, which received such an impetus from the January rains, suffered everywhere (particularly in the lighter soils) from the strong west wind, which blew almost continuously during the last two days in February, and the first few days in March. Caterpillars also attacked the pods when well formed, and as far as I can ascertain the loss in gram from this cause alone has been almost one-third. In counting the pods on the threshing floors and in the field, as I have done many times within the last six weeks, I found on the average between 26 and 30 pods in every 100 empty, *viz.*, with the gram destroyed by these insects It is a curious fact that the caterpillers did not attack the gram grown in kans land.

Taking everything into consideration, as far as I can judge the gram crop has been about a ten-anna one.

A patch of land in my compound which last year produced 45 maunds of gram has only produced 27 maunds this year; although it was heavily manured by me. The soil however is light *parua.* The outturn per bigha was 6¼ mounds last year against 4 maunds this year.

THE SNAKE PLANT.

THE excessive damp of the rains, says a Simla correspondent, has of course caused all vegetation to spring up with a redundancy of growth most astonishing, but this year it has been observed that a bulbous plant which has always been most abundant during the rainy season in itself, and poisoning the air around with its nauseous rank smell, is conspicuous by its almost entire absence. I refer to what is commonly known as the "snake plant." I believe its proper name is *monk's hood*, and it is of the same species as *aconite*. The flower resembles in shape a hood out of which a long pistil projects, having the appearance of a snake's tongue; this turns into a stalk carrying bead-like seeds turning red when ripe. The plant, leaves, stalk, and all is spotted and striped like a snake; hence the name, and is in every part deadly poison. It was observed during the year that cholera was raging up here, this plant was more than usually abundant, while this season it is scarcely to be found. I state a fact which men of observation and science may be able to turn to account; whether the absence of this deadly plant has any influence upon the salubrity or otherwise of the atmosphere, I leave others to pronounce.

THE BELLARY COTTON CROP.

A NOVEL experiment in cotton cultivation is now being carried out in the Bellary district. Owing to scarcity of labour after the famine, many of the cotton plants which bore last season's crop have been left in the ground, instead of being pulled up, as is customary. The ryot farms on the supposition that his cotton plants are only good for one season's crop, and that they ought to be removed before the ground is prepared for cholum. The Bellary ryots are now puzzled to see the old plants in a state of vigorous growth. After the splendid rain the district has lately received, the country is everywhere covered with pasturage, and the old cotton plants have sprung into new life, and are putting forth new leaf and new flower, while the young plants which are intended to produce next season's crop, are only just shooting out of the ground. Travelling by train between Adoni and Goondacul, one may see hundreds of acres under cotton cultivation either with the new or the old crop. The ryots are now anxiously asking themselves if these old plants of last year are going to yield a second crop of cotton? If they do, an important "wrinkle" will have been gained in the knowledge of cotton culture, which may have an important bearing on the future supplies of the staple; while it is tolerably certain that next year's crop will be a bumper one. A gentleman who has travelled in the South Sea islands informs us that the native cultivators there allow the cotton plant to bear for several seasons in succession, and he was surprised to find our cultivators were in the habit of sowing a fresh crop every year. It is just possible the Indian ryots may find they have been incurring unnecessary labour and expense in destroying the old cotton plants. It will be interesting to observe the effect of the present experiment—the result of an accident, it may be said, for the ryot would never have thought of trying it on such a large scale, but for the famine—and we hope the Bellary officials will make some record of it. Should the old cotton plants bring forth a second crop, there would be some risk, we fear of its being damaged by the North-East monsoon rains. But should these rains be light in Bellary, it is possible the crop might come to maturity, in which case it would probably be in the market before the ordinary crop was ready to be picked.

"A EUROPEAN" Correspondent writes to us from the Northern Division of the Nellore District .—

"As in the Bellary District, so also in Nellore District, are last year's cotton plants to be found, fields of them, growing most vigorously; but I am not sure whether the ryots of Nellore propose experimenting, as purposed by their brethren in Bellary. The matter, however, is no new thing, for in Masulipatam, on my father's farm, the edges of fields were planted permanently with the cotton plant, an American variety, and I remember the trees were as vigorous as possible during twelve years, and would have been still standing presumably, but for the cyclone of 1864. The trees were about 6 feet high, with large outspreading branches, and yielded a crop of cotton year after year, without any particular attention. I can shew you table-linen made out of that stock. I have frequently endeavoured to impress ryots with the above *primâ facie* evidence of what might be successfully carried out by them. But it is of no avail, and there is no prospect either of progress in that direction, unless Government encourage European farmers: but we may see European farmers on the day that Europeans are substituted for Hindoo Tashildars, for it is an incontrovertible fact, that every obstacle is placed in the way when Europeans and Eurasians endeavour to obtain land for farming in the plains. It won't pay the Tashildars to permit it, and curiously enough, they carry the day with our administrators, who, being Europeans ought to encourage farming. But like many other things, of a kindred nature the above circumstances account also for the fact that Europeans are kept out of Tashildar's appointments; and wherefore? The reason is best unsaid, for it will be discreditable to to our administration, withal there is so much said and written about the corruption of Hindoos."—*Madras Mail.*

TOBACCO IN TRAVANCORE.

THE first Prince of Travancore in a minute lately written by him suggessting certain improvements in that State, says :—

"On the cultivation of tobacco I have to say a few words. I have myself made experiments in tobacco cultivation, and the results have been a *complete success.* Even in the manipulation or sorting of the article there is hardly any difficulty, and experienced manufacturers from British India and Ceylon can be easily induced to settle in Travancore. Tobacco cultivation will open up a field for the profitable employment of capital. When the *Sirkar* held in its hands the famous (or rather infamous!) tobacco monopoly, the local production of the article had, as a natural consequence, been strictly prohibited. Now that the tobacco trade has been opened to all and only subject to the payment of an excise and selling at particular places, it is quite time to remove the prohibition on local cultivation. A *formal* abrogation of the prohibition by the *Sirkar* is necessary. Local cultivation of tobacco can easily be kept aloof from fraudulent trade and other evils. The proportion of produce to the acreage can be ascertained from men of experience, and the extent of land under tobacco cultivation can be made subject to the inspection and estimation of the Proverty sub-officers. The rate of excise realized upon foreign tobacco of the same description may be levied upon the home produce, while the cultivators may be held free to sell their produce at any price. This matter, I believe, has not came to the notice of the resident, and any European capitalists who may point this out will confer a great good upon the land."

MANUFACTURES AND MINES IN CHOTA NAGPORE.

THERE are several lac factories in Manbhoom, the palas and kusum trees, both of which yield lac in large quantities, being very abundant in the district. The industry is, however, as noticed in last year's Resolution, a declining one, and the large lac factory at Dorundah in Lohardugga has this year been forced to suspend operations. Coal is found in each of the districts of the division, but the mines of Singbhoom and Lohardugga were not worked during the year. There are seven coal mines in the the Pachumba sub-division of Hazareebagh, but in only four were operations carried on, and of these by far the most important is the Kurhurbari mine leased by the East Indian Railway Company from Government. The average number of men employed in this mine during the year was 4,500, and the yield of the year was 808,386 tons. The shafts are for the most part shallow, and entirely free from fire damp, and bare torches are used by the miners at their work. The coal mines of Manbhoom should have been more fully noticed in the report. The fields of Raneegunge extend some few miles west of the Burrakur river, but no information is furnished in the report as to whether these mines were worked during the past year. The Lieutenant-Governor understands that in the year 1876-77 several pits were being worked within the Govindpore sub-division. Mica appears to have worked at a profit in the Hazareebagh district, but no successful attempt has been made in recent years to work the copper mines of Singbhoom and Hazareebagh.

It is interesting to note that in Palamow the local sugar manufacturers are using extensively the hand mills patented by Messrs. Thomson and Milne of Behar, and that this industry shows signs of a rapid increase.

The report altogether omits to notice the tea industry of Hazareebagh. This cultivation appears to have been lately much extended in the Lohardugga district. The last two seasons have suited the tea planters exactly the older concerns have shown good returns, and ten new gardens have been recently opened out. The condition of this enterprise in both the districts of Hazareebagh and Lohardugga should be noticed at length in future reports.

MAKING THE BEST OF BAD LAND.

GREAT works of land reclamation and improvement are going on in Russia and France. Those in Russia are being taken in hand by the State in the northern and north-western Governments of the Russian Empire. In the latter of these the task undertaken is nothing less than the reclamation of the enormous wastes of Polessje, which cover an area of 8 000,000 dessjatines, or about 80,000 square versts. Only about 9 per cent. of this land is at present under cultivation the rest being all moorland, sandrift, and woods. Highways and branch roads are almost unknown, and such few as exist are scarcely practicable, except when frozen over in the winter months. Under such circumstances, the district is naturally but sparsely populated in proportion to other parts of the country. Elsewhere, also, similar improvements are projected, or have been already started, though on a somewhat smaller scale. In the Novgorod Governments, 189,332 dessjatines of swamp were surveyed last year and its drainage commenced, and 1,230 square versts of land were levelled; and in St. Petersburg Government, twenty-two moors, covering altogether an area of 84,111 dessjatines, were planned out for reclamation

In the very middle of the French territory there exists a considerable tract of country, which is not only unproductive of any valuable crops, but also most dangerous as a place of residence. The district in question is called the plain of Forez, and it extends for some twenty-five miles in length from north to south, and about twelve miles in breadth from the mountains of the Forez to those of the Beaujolais country, near Saint Etienne. It has a nearly flat surface, divided into two unequal parts by the Loire, and contains almost 62,000 hectares, or 155,000 acres. Over this surface are scattered a quantity of pools or lakes of different sizes, which have hitherto been for the most part managed in the following manner.—During two years they have been allowed to accumulate the water which runs down from the surrounding mountain ranges, and have served as fish ponds: in which coarse fish were first bred and then caught and eaten by the neighbouring inhabitants. For the following two years the ponds have been drained as well as could be, and the ground used for the cultivation of grass and some sorts of cereals. But neither in the wet years nor the dry years, the season of corn or of carp, has the country been either really dry or properly submerged. A stagnant morass has always been the best description for the greater part of the plain, and the miasma arising therefrom has been continually productive of terrible fevers. This is the country upon which the engineers employed by the department have been working for some years past. It is now said that their operations have succeeded, and that the outlay of capital is beginning to be remunerative. At the same time the drainage water has been utilized for purposes of irrigation.

THE GARDEN.

ROYAL BOTANICAL GARDEN, CALCUTTA.

THE following is the Government Resolution on the Report of the Royal Botanical Garden, Calcutta, for the year 1877-78:—

The Superintendent is quite justified in saying that the appearance of the Garden, particularly on the eastern or Howrah side, has been considerably improved by the alterations which have of late years been carried out under his orders, and which are now beginning to show their full effect as the plants grow up. The scattered tanks have been enlarged, improved in shape and connected, and the trees that were not too large to be transplanted have been collected into groups, while the soil has been rendered undulating, and the ground generally treated with a view to producing good landscape effects. The Conservatory, built in 1874, has been extended, and the new Plant-house, constructed last year, has proved successful. The western end of the Garden, however, lies very low and presents an unsightly appearance. The changes suggested by Dr. King, with a view of laying out this part of the Garden, have the Lieutenant-Governor's entire approval, and estimates should be made for deepening and widening the serpentine water, and throwing the earth obtained by excavation into slopes and undulations. The general improvement in the Garden of late years has been very marked, and the new Plant-houses have been thoroughly successful.

2. Considerable additions have been made to the Herbarium during the year. The chief of these is the collection of the late Mr. S. Kurz, Curator of the Garden, who, prior to his death, presented to the Garden the whole of the specimens of plants collected by him from all parts of India, besides a number of Malayan species and European plants. A very interesting collection of plants made at the Cape of Good Hope in 1797 by the late Dr. Roxburgh, has also been presented by his surviving daughter. The building in which the Herbarium and Library are placed is not suited for the purpose, and the accommodation which it affords is insufficient. The necessity for enlarging this building was admitted in 1876, but want of funds has hitherto prevented this necessary improvement being carried out. Arrangements have now been made to secure the enlargement and improvement of this building, and the work will, if possible, be done during the current year. The Superintendent should at once place himself in communication with the Public Works Department in regard to the additions and alterations required for the Herbarium and Library

3. The present report, again, shows that the experiments which have been tried for some years past in cultivating in Calcutta certain special plants, have not been attended with success. It is useless to attempt to grow in Calcutta plants to which the climate is entirely unsuitable, and all that can be done is to endeavour to import, propagate, and raise young stock for distribution to suitable localities. Dr. King is endeavouring, by means of artificial propagation, to grow a sufficient stock of the *Para rubber* and *Ceara rubber*, plants of South America with a view to their being ultimately formed into small plantations in places possessing a suitable climate, and where efficient supervision can be secured. The cultivation of *vanilla* must be abandoned, as it is now a decided failure The *ipecacuanha* also cannot be successfully grown in Calcutta as a crop, owing to the low night temperature of the cold season proving too severe for it; but a stock of young plants is kept at the Cinchona Plantation for distribution. *Rheea* does not thrive in Calcutta so well as in the drier climate of Saharunpore, but the Government of India having again offered a prize for the invention of a machine for cleaning rheea fibre, Dr. King has, very properly, put a few acres of ground under the plant to meet applications for green stems. The *Eucalyptus* is not suited to the climate of Lower Bengal. The *Carob*, which, if successfully cultivated, would afford excellent fodder for cattle, has been found to fail. But another fodder-plant, the *Pithiocoleum loman* of Peru, seems to be well suited to the climate and soil of Bengal. Some of the trees have during the year given seed: the pod is quite as sweet as that of the carob, and is abundantly produced, while, as a rapid grower, the tree is unrivalled.

4. Dr. King has paid particular attention to the important experiment of growing the various kinds of paper fibres which have from time to time been suggested to him: but the result of his experience is not very hopeful. The *Baobab* does not yield an annual crop and cannot be grown with sufficient cheapness to pay. The proposals of Mr. Routledge, who has devoted much attention to the subject, about coppicing bamboo, and extracting from its immature shoots a stock fit for the manufacture of paper, have been put to a practical test during the last two or three years. Although the experiment has been conducted under the most favourable circumstances, the twigs produced by each clump of bamboos are not the soft succulent shoots which are required for Mr. Routledge's process, and on the whole Dr. King thinks that the proposed industry is not likely to succeed in India Specimens of four common Indian plants were sent to the India Office in order that their value as paper-fibres should be ascertained. The plants were tested by Mr. Routledge, who found that they could be employed in making paper, but the cost of converting them into stock and of transport to Europe would doubtless be so high, as to prevent any attempt to use them for the manufacture of paper from being commercially successful. As suggested in the Government Resolution on the report for 1876 77, Dr. King has procured specimens of the grass which grows on the Orissa and Chittagong coasts, and hopes to report the result of his enquiries in future reports. His

attention is again drawn to the grass which grows on the banks of the Adjai and Damoodah, and the Lieutenant-Governor will be glad if he will enquire whether the grass cannot be utilized as a paper fibre.

5. The attention of the Inspector-General of Jails will also be directed to the use of these grasses as paper-making material, and experiments may be carried on by him in some of the jails in which paper-making has been adopted as a regular jail industry.

6. The interchange of plants and seeds has continued to be made during the year, though not to the same extent as in the preceding year. The thanks of Government are due to the gentlemen noted in paragraphs 11 and 12 of the report for the contributions received from them.

7. The Lieutenant-Governor fully concurs with Dr King in regretting the very great loss which has been sustained by the death of Mr. Kürz, the late Curator of the Garden.

8. The acknowledgments of the Government are due to Dr. King for his very able management of the Garden during the year.

THE following extracts from the Report will be found of interest —

India-rubber.—The seedlings of Para rubber received in the beginning of 1877 were partly retained in this garden and partly sent to the cinchona plantation in Sikkim. Several of these plants have died during the year. The plants that still remain here (14 in number) are, however, healthy, and have grown fairly well. Every care is being taken of them, and I hope soon to be able to report that they have been increased in number by artificial propagation, but former experience has made me wary of allowing cuttings to be made until the parent plants have had plenty of time thoroughly to establish themselves. A quantity of Ceara rubber plants, collected in in South America by Mr. Cross and sent to this garden by Sir Joseph Hooker, were received along with the Para rubbers About one-third of plants in this consignment were found on arrival to be in bad condition or dead. Of the remainder, five were sent to the cinchona plantation, and the balance were retained here. One of the plants here is now ten feet high, and the others vary in height from two to five feet; but they all look more or less weak and lanky, as if the climate were too damp for them. This plant (a species of *manihot*) was found by Mr. Cross in quite a different kind of country from the Para rubber, and it appears more likely to succeed in India than the latter My object, both with the Para and Ceara rubbers, will be to propagate as large a stock of young plants of each as possible, to find out spots with climates suitable for each, and to have small plantations made wherever efficient supervision can be secured in such places.

Vanilla.—Further experience has only strengthened my conviction that *vanilla* cannot be grown as a crop in the climate of Calcutta with any prospect of success. I observe that even in Bangalore, where for a time it was supposed to have promised well, a similar conclusion has lately been arrived at. The plants now in the garden will, of course, be attended to; but I do not think it is worth while to go to any further expense in attempting to make a plantation of it to be conducted on commercial principles.

Ipecacuanha.—A number of plants of ipecacuanha have been sent to the Botanical Garden at Singapore, which enjoys a climate, that ought to suit ipecacuanha perfectly. A considerable stock of young plants is kept on hand at the cinchona plantation ready for issue to any applicant. But, like *vanilla*, I fear this valuable drug can never be grown successfully as a crop in any part of Bengal. We have been perfectly successful in propagating the plant from root, cuttings, and seed, and it grows luxuriantly under cover But out of-doors the low night temperature of the cold weather proves too severe for it. During the year, 26lbs. of the dried root, taken from plants grown in frames under Mr. Jaffrey's care at Rungbee were sent to the medical depôt for use, previous trials having established the excellence of the Sikkim-grown drug.

Rhea.—The Government of India having decided again to offer a prize for the invention of a machine to clean rhea fibre, a couple of acres of ground were put under this plant in order that intending competitors might be supplied with green stems to work with The ground having been trenched and manured, the crop offers to be a good one, but rhea does not appear to me to grow with such luxuriance here as in the drier climate of Saharanpur, where the competition for the Government prize is to be conducted.

Baobab, Bamboo, and other Paper Fibres.—The curious baobab tree is a native of Africa, but appears for a long time to have been a favourite with Mussulmans in India. Large trees of it are found planted near Calcutta, Patna, Agra, and at many other places in India. Baobab bark began some years ago to be largely imported into London from the Portugese settlements in Africa, and proved an excellent paper fibre. At the suggestion of Sir Joseph Hooker, I made three years ago a small plantation of it with the view of testing the possibility of growing it sufficiently cheaply to be used as a paper fibre. For the past two years the plants put out here received a rough kind of cultivation, and the grass between them was regularly cut; but, as this could hardly be afforded in a plantation conducted on commercial principles, I did not think it fair to the experiment to continue even the little cultivation which the plants had hitherto received. During the past year, the young baobabs have therefore had to fight their own battle, and it is quite clear that the majority of them are going to be mastered by the coarse, deep-rooting grasses which infest the soil everywhere in the plains of Bengal. Such plants as enjoy the shade of a large tree in the neighbourhood of the plantation continue to look very fairly healthy, but those that stand in the open look very sickly. If baobab were to be grown to profit, it would be hardly feasible to give it cultivation, however rough, after the first year, and it might not always be possible to give it shade. Considering, moreover, the comparatively slow growth of the species (a tree of 20 years old grown in the open girths, about 3½ feet at the base and is about 15 feet high), I am driven to the conclusion that baobab is not likely to afford in India a sufficiently cheap paper fibre. My own impression is that a plant yielding an annual crop is more likely to fulfil the financial conditions of success than any perennial which, like baobab, yields a crop only after many years. Acting on this conviction, I sent to the India Office samples of four common Indian plants, and suggested that their value as paper fibres should be ascertained. The samples consisted of the stem and leaves of (1) the *bhabar-ghas* (*Eriophorum comosum*) of the North-West Provinces, which is so largely used as a material for ropes in Upper India; (2) of *Saccharum spontaneum*, a tall, course grass which under the name of *kash*, is only too abundant in waste places over a large part of India; (3) of *Imperata cylindrica*, the well-known *ooloo*, the commonest grass in Lower Bengal; and (4) of *Typha elephantina*, the *hogla* of Bengalees, a large bulrush abundant all over Lower Bengal in marshy places and by the sides of tanks and streams. *Eriophorum*, not growing naturally in Lower Bengal, would reach a seaport weighted by the cost of long carriage, and may therefore practically be excluded from competition in the export market; but the other three are common plants all over the Gangetic delta, and could be brought to Calcutta in any quantity and at very low rates. The four samples were reported on by Mr. Routledge, of the Ford Paper Works, near Sunderland, who has devoted so much attention to the utilization of the young shoots of bamboo as a paper fibre. Mr. Routledge states that "all four will unquestionably make paper." "*Eriophorum* is," he says "the best and most easily-worked of the four, as a small quantity of bleach brings it into good order." "The ultimate fibre is," he continues, "very fine and delicate, rather more so than *esparto* and of about the same strength. The yield (42 per cent.) is somewhat, less, I think" Mr. Routledge goes on to say, "it will make a quality of paper equal to *esparto* The remainder of Mr. Routledge's report is not very encouraging, but I give it *verbatim*, for I know that the increasing deficiency in the supply, and consequent rise in price of materials suitable for paper-making, have been exciting a good deal of interest for some time, and under such circumstances, the records of failures, entire or partial, are nearly as useful as the records of success.

"The grass marked *Saccharum spontaneum* ranks next to *Eriophorum* in quality; it is more tender, and certainly not equal to *esparto*; it yields 14 per cent. of fibre

"The grass *Imperata cylindrica* I do not think suitable for paper, certainly not for printing, although it may suit for what are termed small hands and rough packing papers. It is full of small joints and knots (especially the lower portions of the stalk), which result in harsh, woody sheaves It gives an yield of 11 per cent.

"The *Typha latifolia* gives a very strong fibre when purged of the glutinous compounds living in its cellular tissue; but, in consequence of this mass of gluten, the yield is very small (only 28 per cent.); it is also extremely difficult to bleach, and loses most of its strength when subjected to that process.

"I do not consider that it would pay commercially to attempt to treat any one of these fibrous materials for conversion into 'stock' for European use, although very possibly, if procurable in abundance and at cheap rates, they might be employed for paper-making, locally, with advantage.

"To come into this (the home) market, any material must be superior to *esparto* in quality, as no matter how cheap the raw material may be in India, the cost and charges for converting it into stock and transport to Europe will bring its price to afford any profit to the producer as high or nearly as high as *esparto*.

"The importer, therefore, must be prepared to sell his stock as cheap or nearly as cheap as *esparto*, reduced to the same condition of stock, and must also give the inducement of superiority of quality."

In the resolution on my last annual report it was suggested that I should get from the Orissa and Chittagong coasts specimens of the wiry grasses growing on the beach. This has been done, but no report on the samples has yet been got I propose to continue to give attention to this subject of paper fibre, and hope to note the results in future reports.

It will be remembered that several years ago, Mr. Routledge, an English paper-maker, drew the attention of Government to the value as a paper material of the fibre yielded by the immature shoots of bamboo. Healthy bamboo clumps, as everybody in India knows send up during every rainy season a certain number of new shoots which, growing with enormous rapidity, in a few weeks, attain their full height, and afterwards slowly harden, and develope leaves. Mr. Routledge expressed his belief that by a simple treatment in this country a "stock" might be extracted from these shoots which might be profitably transmitted to England for manufacture into paper During the past two or three years, I have put Mr. Routledge's proposal about coppicing bamboo to a practical test, and, in my last report, I recorded my observations so far as they had gone. I shall now bring them up to date, but before doing so, it may be convenient to reproduce what I wrote last year. I therefore quote from my last report:—

"It is essential to the success of Mr. Routledge's process that the bamboo shoots be quite young and succulent, and the great difficulty which at once presented itself to persons with any knowledge of the mode of growth of Indian bamboos was that such shoots, being produced in moderate quantity from each clump, and only during a limited season of the year, the proposed paper stock-making machinery must, for a large part of the year, necessarily lie idle. To meet this difficulty, Mr. Routledge suggested that bamboo clumps might, by proper treatment, be induced, after most of their old shoots had been cut away, to send up from the stools thus bared, regularly and irrespective of season, crops of succulent shoots suitable for conversion into paper stock. Mr. Routledge's expectations imply a very complete change of habit in the bamboo, for it is pretty well known that bamboo clumps, if entirely cut down, yield for several years but few and small succulent shoots, and, in fact, not unfrequently die In order however, to submit the proposed scheme to a trial under my own eye, six clumps of *Bambusa Balcooa* were cut down last year, *i. e.*, in 1876 at the beginning of the rains between 10th and 20th June, when the buds of the young shoots of the season had completely formed and were nearly ready to burst through the soil. Soon after the cutting of the old stems, these buds developed into shoots which grew with characteristic rapidity. These were allowed to grow until they began to show symptoms of becoming was not known in scientific circles in India that Queensland is a large and very successful producer of many kinds of the best Bananas. The production is confined to the warm coast lands of the Colony, but occupies many hundreds of acres of the best lands. Some years ago serious alarm was created by the appearance of a disease which destroyed thousands of plants, and great apprehensions were felt at the impending ruin of a large number of farmers who depended for their livelihood entirely upon the Banana. Fortunately, however, this disease proved to take its origin like many others, in purely atmospheric causes, and while remedies were being discussed, it gradually disappeared.

"I believe myself that the figures which I quoted at our meeting might be doubled, and still be within the truth as I have since found that the returns given me by the Customs referred to the Port of Brisbane only."

Extract from the Proceedings of a meeting of the Councireferred to in the above letter. He (the Vice-President) was informed by the Customs Authorities that the total value of green fruit exported in 1877 was £4,992 Crediting bananas with £2,500 of this would be under the mark if anything: and adding, as a moderate estimate, five times the amount as the home consumption, will give £12,500 as the value of this product for 1877 for Queensland alone. But the banana is largely cultivated on the northern coast of New South Wales also, and £20,000 a year would probably not be an exaggerated estimate as the value of the Australian product of this useful fruit which enters so largely into the food of the people. He had no doubt that the writer in question would be glad to be corrected, but he instanced the matter rather to show how much still remains to be done before the outside world knows what are our resources He quite hoped that the International Exhibition to be held in Brisbane in 1880, would open the eyes of at least our fellow subjects in other parts of the British possessions."

COMMUNICATIONS ON VARIOUS SUBJECTS.

From the Director of Agriculture and Commerce, N.-W. P., forwarding a report on poisonous properties of Jowar. (Transferred for publication in Journal.)

From the Inspector-General of Forests, copy of a memorandum by Mr. Gamble, Assistant Conservator of Forests, on the different species of American Prosopis. (Transferred for Journal.)

From the Under-Secretary, Government of India, Department of Agriculture, conveying the thanks of the Japanese Government for assistance rendered last year by the Society to three officials in their investigations connected with the Tea industry of India.

From the Assistant Director Royal Gardens, Kew, applying for duplicate of missing numbers of the Proceeding of the Society, and for two copies of each future number. (To be complied with.)

From the Acting Superintendent, Government Farms, Madras, applying for an exchange of publications. (To be met.)

The letter last submitted was from the Secretary, India General Steam Navigation Company. The Secretary stated that in consequence of several Members of the Society, Managers of Tea Gardens in Assam and Cachar, being deterred from availing of their privileges of indenting on the garden for plants in consequence of the cost of freight on boxes, he had, with the concurrence of the Council, applied to the I. G. S. N. Co. for a reduction of freight in consideration of the large quantity of tea annually brought down by the Company.

From the reply now read, it would be seen that the Directors "had given the subject due consideration, but could not see their way to make the reduction asked for."

GARDENING IN MADRAS.

A CORRESPONDENT in Madras writes —"Most gardens here are pot-gardens, that is to say, all plants are grown in pots which can be easily moved into the verandahs or dining rooms on occasions of dinners, and into bamboo houses for shelter in the hot weather. The crotons strike readily from cuttings and are extremely showy. Some of the new ones, especially the 'Lord Beaconsfield' are very handsome. The demand for them is much greater than the supply, and as a result, innumerable thefts are committed in the gardens of those who are known to be in the habit of getting new varieties, either from Calcutta or direct from England, whence they are sent in Wardian cases A gentleman's garden was robbed the other day of a very large number of plants, amongst them all his new varieties, from which it would appear that the thieves have some knowledge of gardening. I am happy to say he met a man selling these plants, two or three days afterwards, and obtained for him six months imprisonment. A great many confine their gardening operations to their verandahs, in which they can work safe from the sun. People returning from the hills generally bring down quantities of ferns for this purpose, and I have seen some very beautiful effects produced by placing the pots on stands and building up rockwork around. It is not necessary however to go to the hills to get some of the ferns—the maiden hair and another species of adiantum—the *A caudatum* or *lunulatum*, grow here splendidly—the latter like a weed. Masses of maiden hair look very delightful, and the *caudatum*, hung in baskets, drops like a beautiful green fringe from them. More delicate and beautiful kinds are the *cuneatum*, and *concinnum*, and these can be procured in Ootacamund and will thrive well during the cool season, but die off in the hot weather and unlike the two former kinds I mentioned, will not come up again the next year. Fern lovers' collections though, are by no means confined to their few varieties, and at a house, where I was calling yesterday, I saw over forty kinds flourishing in an open verandah.

THE ECONOMIC GARDEN AT SALARU.

THE report by the Superintendent of Cotton Experiments in Sind, of the Economic Garden at Salaru has just been published. This garden is maintained at a cost of Rs. 3,420 a year, not including the salary of the Superintendent, at Rs. 335 a month. There is an item in the account of Rs. 575 for a new well, which is reported to be a valuable addition to the garden and some repairs have been made during the past year; a sum of Rs. 479 8 has been paid into the Treasury on account of the sale of garden fruit produce and 9½ maunds of bajri; so that the monthly cost of the Economic Garden all charges included is about Rs. 500 a month. At this cost a number of experiments are made in growing plants, and seeds, propagating cuttings, budding, introducing exotic plants, rearing varieties of European peach, nectarines and plums, raising coffee seedlings and some cardamum plants from the Punjab, and a variety of young trees, at present in pots only, but which will be planted out in the garden. Besides these useful productions the ornamental are not neglected, and climbing and flowering plants have been added to the stock and roses have been grown, regarding which the Superintendent, Mr. Strachan, says in his report, "the flowers of some of them would not disgrace a London rose show." This list of productions makes a fine show on paper but, as might be supposed, the climate of Sind does not permit much success to attend the efforts that are being made. The sudden change from the cold to the hot weather withers up trees and plants that looked well in the cold weather, and such fine fruit as peaches and nectarines cannot be produced with any approach to perfection, as the blossoms show about the time the hot winds blow and do not expand properly. The same remark applies to European vegetables, very few of which will seed in this climate, and Mr. Strachan recommends that whatever vegetable and flower seeds may be wanted should be imported "as they can be bought cheaper than we can grow them, and, next, their quality is likely to be better." This is a very ingenious way of pronouncing the growth of English vegetables here a failure but it is very convincing at the same time. The Economic Garden is now surrounded by trees which are large enough to give shelter from high winds from whatever direction they may blow, and for that reason some of the mango trees have produced a fair crop and pomegranate plants make progress. There will in future be a better supply of water, so that another year may show better results than heretofore. The produce of the garden is disposed of, and the chief demand was for grape-vines, oranges, guavas, pomegranates, figs and custard-apple. Excepting grape vines and oranges, applicants have been pretty well supplied with all these articles. Among the exotic plants the *eucalyptus* flourishes in several varieties and is described as being "particularly strong and healthy." The Economic Garden can hardly be expected to be a profitable undertaking in such a country and climate as that of Sind; but we must regard it as successful if a desire to improve the little cultivation of the land that is possible is kept alive in this way; and an Economic Garden, properly conducted, as this one seems to be, is calculated to ensure this result at least.

AGRI-HORTICULTURAL SOCIETY OF MADRAS.

PROCEEDINGS of a Meeting of the Committee of the Agri-Horticultural Society of Madras held at the Gardens on Wednesday, the 7th August 1878.

Present—Colonel Cadell c. b., *in the Chair*. Hon'ble J. G. Coleman, Lieutenant E Lewis, H S. Thomas, Esq., F. L. S., &c., C. A. Ainslie, Esq. and Wr W. Munsie, Esq

Joseph Steavenson, Esq., Honorary Secretary.

The Proceedings of last Meeting were submitted and confirmed. The Honorary Secretary then intimated that the following contributions had been made to the Library and Gardens, and a vote of thanks was passed to the Donors. C. F. [illegible]swell's list of seeds, comprising about eight hundred varieties of the chief trees and flowering shrubs indigenous to Australia, Tasmania, and new Zealand. A collection of seeds comprising some of a very beautiful Mimosa, and of a beautiful white creeper, probably a Wrightia, two fresh nutmegs, a number of seeds of jungle trees and shrubs, and a quantity of elaeocarpus seeds brought from the Neilgherry Hills by Mr. Steavenson. Read letter from the Director, Royal Botanic Gardens, Peradeniya, Ceylon, dated 4th July 1878, thanking this Society for a supply of Arachis hypogea seed (ground nut), and offering to reciprocate and send from those gardens such seeds and plants as this Society may desire. Resolved, that the Director be thanked for his kind offer and asked to be so good as to furnish a catalogue of species growing at Peradenya. Read letter from Dr. Shortt, Ercaud, dated 16th July 1878, referring to his "Notes on Fruit Trees at Ercaud," published in this Society's Proceedings of 5th November 1878, in which the ravages of insects on the Orange trees is mentioned, and submitting for the inspection of this Committee drawings of lava, chrysalis, and imago of a butterfly—*Ornithoptera remus*—which he believed to be the author of the mischief—a mischief so serious as to give the plants the appearance of having been cropped by cattle. Resolved, that Dr. Shortt be thanked for the trouble he has taken to add to the information contained in his former notes, and asked to be so good as to furnish this Society with further details of his observations. Read an extract from Dr. Schomburgk's report on the Progress and Condition of the Botanic Garden and Government Plantations of South Australia, during the year 1877, which states that at Adelaide, where they have the thermometer ranging from several degrees of frost in the cold season to 116° in the shade and 166° in the sun (on the 10th January 1877) in the hot weather, where they have droughts of three months duration, and occasional heavy bursts of rain, Esparto grass, a native of spain, is perfectly acclimatised. Dr. Schomburgk further states in the Report above-mentioned that Esparto grass has a great mercantile reputation, its valuable fibre being an excellent material for ropes, and, without admixture, for the best writing paper, and is an article of extensive import into England and other places; that it is worth £5 to 7 a ton, that it is said six to eight tons can be obtained from an acre of ground; that it grows on the poorest soil, especially limestone or sand, in fact, where there is no other vegetation, on the sands of the Sahara, on the stony hills, and on the sea-coast; that the plants on the garden grow most luxuriantly, that there is not the slightest doubt that many thousand acres of arid land, in different parts of the Colony scarcely fit for pasture, by sowing Esparto grass may be rendered highly useful and productive; that it is extensively cultivated in the south of France, and it is said no crop there will pay better; that another grass of the same superior quality, Lygiums artium, also a native of Spain and Africa which he has introduced, grows as well as the Esparto, and fetches the same price in the market: and that the scarcity of material for paper becomes more and more apparent year by year, as the consumption increases. Resolved, that Dr. Schomburgk be asked to do this Society the favour of sending a pound or two, or what can be conveniently sent, by an early steamer, of both the grasses abovementioned, as their introduction would probably be of very great value.

FORESTRY.

MR. E. H. PERCIVAL Collector, of Sholapore, has written a memorandum upon the vegetation of his district embodying proposals for the planting of trees where they are likely to be of service. The Collector remarks that "the bleak, treeless appearance of the Sholapur district has been brought to notice by one officer after another since the commencement of British rule, but no decided steps have been taken to encourage the growth of trees, or even to prevent further denudation The demand for firewood has in the last few years been increased by the introduction of steam-engines, for railways, spinning-mills, cotton-presses, and pumps. Many of these engines are worked almost entirely by wood-fuel, and I am told that in the neighbourhood of the Barsee cotton mart, there is a visible diminution of wood since cotton presses were set up." To remedy this state of things, plots of land in each village and along the banks of streams have been transferred to the Forest Department. In all 250 square miles out of the total area of the collectorate, 5,100 square miles, have been so transferred The Governor has passed the following resolution on Mr. Percival's memorandum —"The Governor in Council consider that Mr. Percival deserves high praise for the steady and judicious manner in which he has striven to improve the vegetation of his district, despite circumstances comparatively unfavourable to arboriculture and requests the Commissioner, C D, to convey to Mr. Percival the thanks of Government on this account."

MR. GREIG the Conservator of Forests, has intimated that the demand for charcoal at Nynee Tal is beyond the resources of the Forest Department. Last year it appears 400 trees were consumed, when the charcoal had unrestricted sale at any price up to two maunds for the rupee, whereas this season 2,000 trees had been felled by the end of August. It is beyond comprehension how the consumption has thus already exceeded that of last year by 400 per cent. unless the trees destroyed were mere saplings. This is a little matter we should like to see cleared up.

FROM a memorandum drawn up by Mr. J. S. Gamble, Assistant Conservator of Forests, on the different species of American *prosopis*, it appears that one variety of this tree, the *prosopis pallida*, though a native of South America, has been successfully grown in Ceylon. Its pods are found useful in tanning. The *prosopis glandulosa* grows in Western Texas, and is there called the Mesquit. The pods of this tree, it is believed, are useful for fodder and are not injurious. It yields an excessively hard and durable timber, and is used for furniture, picket-poles, and in the manufacture of charcoal. It also, affords a large quantity of gum resembling gum-arabic. The *prosopis pubescens*, called the 'Screw Bean' or 'Screw Mesquit,' grows in Texas, New Mexico, and Arizona. The pods of this tree are said to be poisonous to horses, though not injurious to cattle. The fruit of the *prosopis juliflora*, a native of Jamaica, has, however, undoubted poisonous qualities; it is very difficult to eradicate when once planted.

A PROPOSAL is afloat to buy out the rights and interests of zemindars and ryots in the trees they may have planted along road sides. Considering the mileage of the roads which intersect even the smallest district, the proposal does not recommend itself as likely to be of advantage to the cause of arboriculture. If trees are planted 30 feet apart, about 350 will be required for each mile of road, to be planted on both sides. There must be few, if any, districts with less than 200 miles of road, first and second class. If it costs, at a moderate computation, four annas to plant one tree, we attain the respectable total of Rs. 17,500 for each district. Now the grant for arboriculture is at the outside Rs. 500 per district. It would take therefore thirty-five years for avenues to be planted along all the roads. This is of course an outside calculation, but it is evidently bad policy to discourage those to whom tree-planting is a duty, as well as a pleasure, from assisting in a work now recognised as most important. If zemindars and cultivators were allowed to plant trees with due restrictions as to kind, position and nurture, the privilege of taking the fruit and dead wood would be but a small return for so great a benefit. It is needless to say that any attempt to buy out existing rights would result in vexatious litigation, and cost a sum of money out of all proportion to the supposed advantages to be gained.—*Pioneer.*

AN AFRICAN BAISA, *Bois flot*, OR FLOATWOOD.—The Bimba (*Herminiera claphroxylon*), a tree of tropical Africa, belonging to the *n. o* (natural order) of leguminosæ is remarkable for the extreme lightness of its wood—so light indeed, that it would seem to be useless except perhaps for lining entomological drawers, or for sun-hats. It seems, however, that the natives use it for making boats or rafts, as the Brazilians and shore-people of Ecuador and New Granada on the Pacific, use the Tacarigu (*Ochroma legopus*)—rafts which are so buoyant as to be perfectly unsinkable even in the heaviest surf, the boat or floor of the raft, though often filled or washed over by the sea, coming up like a cork. The African tree grows to a height of about 20 feet, with a trunk about 1 foot in diameter, similar dimensions to those the *bois flot* reaches in favourable conditions in these latitudes, as we read of the balsas of Pernambuco and the West Coast being made of straight logs of some length The smoothness of our sheltered waters has relieved the natives of Trinidad, old or modern, from employing their ingenuity in making similar constructions, yet they might be found useful for carrying passengers, produce, and supplies, &c, to or from vessels in the offing, through the oft-times dangerous surf of the East and North coast. It may be remembered that the hazards of transporting people and cacao, &c, through the surf, was the reason the *Arthur* in its one year trial had so little intercourse with the latter fertile but exposed and reputedly feverish coast.

THE trunk of a tree, without roots or branches, has been known to strike root and grow luxuriantly after being in a dried state for several years; at least, so says the Dutch horticultural Journal *Sieboldia*! The tree had been sent from the Cape of Good Hope to Amsterdam, and thrown into an outhouse; thence to Leyden, where it was again consigned to limbo, and after that it was planted, and is now said to be one of the finest specimens of its kind. *The Journal of Forestry* speaks of this as "a tree in a trance," which is a very suggestive heading. If there is any truth in the story, however, those who want to adorn their grounds with ready made trees had better take the hint. If the trunk of a tree will grow fresh roots and a fresh top, then let no man henceforward bother himself with seedlings.

CASHMERE territory has become famous for its walnut wood. A French firm have taken an extensive lease, and it is calculated that from twenty to thirty thousand tons will be exported to France yearly.

IMPORTANCE OF THE CATALPA TREE FOR ECONOMIC PLANTING.

BY C. S SARGENT, DIRECTOR OF THE ARBORETUM OF HARVARD UNIVERSITY MASSACHUSETTS

THE Catalpa (*Catalpa syringæfolia syn. bignonioides*), long known and generally planted as an ornamental tree, has of late years begun to attract considerable attention as offering peculiar advantages for economic planting. The wonderful durability of the wood of this tree, long ago pointed out by General Harrison, but until lately imperfectly understood; its rapid growth in good soil, and freedom from the attacks of insects, makes the Catalpa a most promising subject for general planting in rich, strong soil in any portion of the United States south of the 42nd parallel. Further north it often suffers in severe winters, especially when young; and in the New England States, except in rare localities, the soil is not rich enough to make the planting of this tree as profitable as that of many others better suited to reach maturity in that northern section of the States.

The wood of the Catalpa is soft, light, close-grained, and susceptible of a good polish. In general appearance it closely resembles chestnut, but unlike that wood it is easily "filled," and shows none of the tendency to warp or start, which renders chestnut unfit for the best cabinet work. Should the wood of the Catalpa ever reach the market in quantity, it will rank with butternut for cabinet and architectural work, and will make a valuable addition to the hard woods now so freely employed in interior decoration. It is, however, for railway ties, fence, and telegraph posts, hop and vineyard poles, and such purposes, that the wood of the Catalpa is particularly adapted, and it is for these and similar employments, where a wood capable of resisting decay when exposed to the soil and weather is required, that Catalpa will probably be more profitably employed than the wood of any other tree suitable for cultivation over so large an area of the United States.

Why the soft wood of this fast-growing tree, which is traversed with large open ducts, nearly as broad as those of red oak—a wood which notoriously rots very quickly—should resist decay longer than almost any other of which we have any knowledge, is not clear, and this fact presents a problem for which a chemist may perhaps be able to find a solution. The fact, however, is undeniable. Samples of Catalpa wood are before me, taken from the top and bottom ends of a post which is known to have stood in the ground in Indiana for seventy-five years, and which are still perfectly sound; and many other similar instances of its power to resist decay are recorded. Another peculiarity of the Catalpa is its small amount of sapwood or living tissue, so that, unlike the red cedar and most exogenous trees, in which the soft and worthless sapwood turns by death into durable heart-wood only at the end of many years of growth, the Catalpa produces heart-wood when the stem is scarcely an inch in diameter. For this reason no wood equals the Catalpa for fence-posts and the different sorts of small stakes, for which, if other woods are used, many years of growth must be sacrificed in order to avoid the rotting away of the outer and living layers, which have no power to resist decay.

The few experiments which have been made with Catalpa wood for railway ties seem to promise that it will be of great value for that purpose, although such experiments are neither frequent enough nor of sufficiently long duration to be entirely conclusive and it is evident that a much longer test than it has yet been subjected to is necessary to demonstrate that it has the power to resist the crushing of the rails, and to hold spikes equally well or better than chestnut or white oak, which, all things considered, are the best North American woods yet extensively employed for this purpose. It is but fair to say, however, that many practical railway men of excellent judgment, who are carefully watching in the West the Catalpa ties, speak with great confidence of their value, and already very large experimental plantations of this tree are being made in Eastern Kansas by one of the railroads of that State, with a view of raising their own ties in the future. The Catalpa would seem, then, to be one of the most valuable trees which our farmers, suitably situated, can plant. It grows readily and rapidly from seed, and can be very easily transplanted either in the spring or autumn. If planted thickly—say four feet between the plants each way—they will run up with tall straight stems, and make trees very different in appearance from the short stemmed round-headed, and rather distorted looking specimens which are generally met with in ornamental grounds, especially in the Northern States. The thinnings of a grove of Catalpa, if planted in good soil, will in very few years be large enough for vineyard stakes and hop poles. In about a dozen years the alternate plants will each make two or three fence-posts, and the remainder will in twenty-five or thirty years from the time they were planted, probably be large enough to cut each into five or six railway ties. Farmers to whom the annual expenditure for post fencing, or stakes, is a considerable one, will do wisely to plant every year a few hundred or thousand of Catalpas, according to their circumstances, and thus insure for themselves an abundant supply of home-grown material. Should the objection be raised that the planter of trees must wait too long for his returns, it must be borne in mind that the money value of a farm will be largely increased if it has upon it a thrifty growing grove of Catalpas or other valuable trees, whatever their age may be, and that purchasers of farms in the near future are going to look with considerably more attention than in the past to the size and nature of the wood lots.

A well-marked variety of the Catalpa is recognised in cultivation in some of the western States, flowering two weeks earlier than the ordinary form, which it is said to greatly excel in hardiness, with larger white flowers, and more upright, rapid growth. This variety, which reproduces itself from seed, is the best to plant. Seeds of it can be procured through Mr. E. E. Barney, of Dayton, Ohio, who has long taken an active interest in the Catalpa tree, and done much to make its merits more generally known. He has lately published a pamphlet on the subject ("Facts and Information in Relation to the Catalapa Tree"), procurable from the author at the modest price of two 3-cent postage stamps, which should [illegible] by all—and their number should be legion—who intend planting this tree. Mr. Barney has favoured me with several large and instructive sets of wood specimens of the Catalpa, with which I have been able to enrich the principal museums of economic [illegible] in this country and in Europe.

THE RAIN TREE.

THE Honorary Secretary of the Madras Agri-Horticultural Society has reported that the seed received from Kew and from Dr. King of Calcutta, and said to be that of Pithecolobium saman, has germinated and grown freely, the young plants appearing to be identical, with a tree long known to him in Madras as a marvellously fast growing and beautiful one, under the name of Pithecolobium umbellatum. A specimen in the gardens, as far as can be ascertained, under six years old, now measures in girth 5 feet 5 inches at the ground, 4 feet 1 inch at the height of three feet, and 8 feet 10 inches just below the first branch 6 feet 1 inch up; it is by measurement about 40 feet in height, and it has a spread of 70 feet in diameter from north to south, and about 160 feet in circumference. This tree has produced seed. Mr. Deschamps has several trees a year or two older, which produce seed freely. A young Pithecolobium tree was planted by Mr. Steavenson in the compound of the Madras Club on 28th November last, when about two feet high, and is now about 10 feet high. On 7th October last, Mr. Steavenson planted two trees of about two feet high, in low ground, sheltered by casuarina trees, amongst the sand hills on the seashore at Suolauganollore, fifteen miles south of Madras, which now measure, the one 13 feet and the other 12 feet in height. The tree is evidently of great value, though much more will doubtless be known of it in a year or two, now that special attention has been called to it. The grass does not seem to grow very well under the specimen in the gardens, the shade being apparently too dense. There are in the gardens four plants received from Mr. Cameron of Bangalore, under the name of Pithecolobium saman, and acknowledged in the Proceedings of 3rd January 1877, which differ most materially from that the seed of which has now been sent from Kew, and in which the Secretary of State for India is said to be taking so much interest. It may not be generally known that the Coorkapillay (Ingadulcis) the commonest hedge plant of Madras, of which the leaves and pods are so largely used as fodder, and the timber as fuel, is also known to botanists as Pithecolobium dulcis. In a letter from Colonel Beddome, the Conservator of Forests, just received, he states that the Inga saman mentioned in this last Forest Report as growing in the plantations in Cuddapah, North Arcot and Tinnevelly, is the same tree as that of the seed of which Government has lately sent him a large box under the name of Pithecolobium saman, that it is a West Indian tree, and that he introduced it ten or twelve years ago. The Society now has ready for distribution a large number of fine young plants, raised from the seed received from Kew, from Dr. King, and from Mr. Deschamps. The Honorary Secretary produced some specimens of woodcut from the stem of the Grevillea robusta, which was blown down on 24th May last, with a most beautifully marked grain which should give it a very high value for the cabinet-maker. This tree is in Madras at best but a sickly exotic though pretty and growing as the one in question did, to a girth of about 3 feet, but at Coonoor and Bangalore, and at places with such climates as Muddeenpully in the Cuddapah district, it would probably pay well as a plantation tree. It does not thrive very well in the climate of Ootacamund, at least in such parts of it as are exposed to bad winds or frost. Lady Napier who was a very great admirer of the graceful form and fern-like leaves of this tree, planted an avenue of it at the entrance to Ootacamund, between the road to Walthamstowe and the bridge over the stream at Charing Cross, but after she left India every tree died from frost, or neglect, or both, affording a convincing proof that it is not there hardy enough to take care of itself. The tree in the gardens was believed to be about twenty years old, and never flowered. Its heart wood, for six feet from the ground, was quite decayed.

INDIAN FORESTS.

SIR RICHARD TEMPLE was, it is well known, deeply impressed in the course of his famine tour with the evils arising from forest denudation, and his impressions speedily bore fruit in the shape of energetic and earnest protests against a state of things which, as ocular evidence had convinced him, was tending to increase the probability and enhance the severity of Indian famines. In a minute recorded in April last, he called attention to the serious effects produced on the rivers of the country by the destruction of the forests and jungles about their sources, and generally over their catchment basins. These results have long ceased to be matters of controversy with all who have paid the least attention to scientific forest conservancy. There are conflicting opinions as to the direct effect on the rainfall, though we believe the opinion last arrived at, to be that, there is evidence that, under some circumstances, large blocks of forest do exercise such an effect. But there is absolutely no difference of opinion as to the evils produced on the river-flow and spring-water supply of the country, and on the general climate by the indiscriminate destruction of forests which has been going on for so long in many parts of India. The universal testimony is that forests and jungles with their dense foliage and the *humus* formed of decayed leaves and branches, act as so many huge sponges, retaining the rainfall, and giving it time to flow gently and gradually into the reservoirs from which springs take their rise and rivers receive their supply. In some sorts of forest, it is computed that four-fifths of the rainfall is arrested by the trees, and only by slow degrees finds its way to the soil. The consequence is that when mountains are denuded and river beds laid bare, the evil results come about which so vividly impressed themselves on Sir R. Temple's notice in the Madras Presidency. The dry and rocky soil has no longer the means of retaining the moisture by which its condition might be improved. The rainfall pours away tumultuous and destructive torrents, which find their way to the sea, leaving ruin instead of fertilization in their wake. In Chingleput and North Arcot, this was especially observable. Owing to the destruction of the forests on the upper course of the Palar, this river, which supplies the tank system of those districts, had altogether ceased, Sir R. Temple found, to descend in a seasonable and propitious manner; it was either in flood or nearly dry, and the district suffered accordingly. The same phenomenon might, we believe, be witnessed, by any one who chose to examine the facts attentively, on every river in India. The rise and flow of the huge glacier-fed floods of the Upper India are regulated, of course, by other and more powerful agencies; but it is questionable whether even the Indus and the Punjab river system might not be in some degree controlled and better utilized by judicious forest arrangements along their upper course. At any rate, there is in Central and Southern India an unlimited field for the efforts of Dr. Brandis and his department. In the Deccan, we observe, Sir Richard Temple, in his famine minute, calls attention to the like results ensuing from the destruction of the jungles, and insists on the necessity of a new and more enlightened treatment of this portion of the resources of the country. Not only, he says, should forests near the sources of rivers be preserved, " but something must be done to restore the jungles which once clothed the low hills intersecting the Deccan in all directions, which now are almost gone, but which would grow again if preservative and restorative processes were adopted. The treeless aspect of the distressed districts and the extraordinary barrenness in respect to spontaneous vegetation convince every observer that they must be, while thus situated, the prey of agricultural misfortune and the sport of the vicissitudes of the seasons."

This is sound and wholesome doctrine, and Sir Richard will, we trust, have an opportunity of practically enforcing it not only in the Deccan but through the presidency at large. We will venture, however, to call his attention to a circumstance of which we are quite sure that he cannot be aware,—*viz.*, that in parts of his territories the most barbarous and wasteful destruction of forest and jungle is not only going, but is actually being encouraged and developed by the orders of the revenue officials If we are not misinformed, *kumri* cultivation, one of the worst of those primitive forms in which the aboriginal inhabitants of the country abused and destroyed its forests, is being sanctioned and extended in the ghât talooks of Satara and Belgaum, the Government of India has protested, the Government of Bombay is unconvinced and stubborn, and so the matter rests. We are quite sure that so enlightened an administrator as the present Governor of Bombay needs only to be informed of such a state of things in order to deal with it as vigorously and peremptorily as such a scandal requires. For a scandal we take it to be, for any body of officials at the present day to sin against the light by setting themselves up in opposition to the sound and reasonable forest policy, which the Government of India, guided by the experienced and intelligent counsels of Dr. Brandis and the concurrent testimony of all continental authorities, has accepted for the enjoyment and development of this important element in the resources of the Empire. That policy is, as we understand it, that forests, as a chief branch of the national wealth, must be treated with all the care, skill, and science which we can bring to bear upon them; that while the forest rights now exercised by a fraction of the population must be remembered, the general interests of the nation and of posterity must not be forgotten; that when those rights are exercised in a wasteful and barbarous manner, fatal to the very existence of the subject matter, to which they apply, the strong hand of the State will intervene in the common interest to prevent the destruction of what is in one sense common property; and that the proper course to be pursued with the object of putting forests on the best possible footing, is for the Government to demarcate various areas, sufficient to occupy and repay the services of a well-officered and well-ordered establishment, to protect these sedulously from fire, grazing, and every other injurious action, leaving the unprotected area to take care of itself. In this way the least possible annoyance is inflicted on the peasantry who look to forest produce for support, and whom forest conservancy is apt to harass; the area of Government operations is clearly ascertained; and its efforts being concentrated on well defined, manageable tracts, the result will be in a few years such a growth of forest timber as will materially add to the national wealth, will meet the growing necessities of trade, and will exercise a perceptible influence for good on the climate, river action, and water-supply of the country. Such, we understand, to be the Government scheme, and every year's experience has testified to its soundness.—*Pioneer*.

MINERALOGY.

THERE is an interesting report in the *British Burmah Gazette* on the coal seams in the Thayetmyo district, about which there has lately been some agitation. The seams are not identical with those in the same district tried in 1855 under the supervision of Mr. Thomas Oldham, but they have the same characteristics, and hold out no more prospect of being successfully worked. They hold out less prospect indeed, for in the former case appearances were deceptive enough to induce experts to advise an experimental working, whereas in the present instance, the report of Dr. J. R. M. Robertson, who was deputed to inspect the newly discovered seams, will show that he can hold out no hope of their being turned to account. " I am by no means sanguine that any coal mining venture at the Thapan *Choung* would result in a pecuniary success, or prove other than a most unfortunate and disastrous undertaking." The seams descend steeply, and their working would, therefore, be difficult, especially during the rains; they are of irregular thickness, and those would therefore be the serious chance of Mr. Oldham's disappointment being met,—of promising-looking beds becoming reduced by degrees till altogether useless; the coal examined is hard and lustrous, but not of good enough quality to compete with any other coals in the market. The cost of carriage from the mines to any place where a sale could be effected would, by present means of conveyance, be prohibitive, while the working of the seams by native labor would necessitate some expense and delay before it could be put into proper trim. It is judged that after some time, some trouble, and much outlay, the coals could be put on the surface at from Rs. 3 to Rs. 3-8 per ton, but the estimated cost of conveyance is very high. After searching inquiry, Dr. Robertson was obliged to put the cost of trans-shipment at no less than Rs. 28 per ton to Kama, or Rs. 14 to 15 to Mengdoon He was subsequently informed that the figures were excessive, but he was forced in any case to conclude that the Thayetmyo coal could not possibly be put down anywhere to compete with Scotch coal. Upon the estimate just noted, the former could not be put down at Rangoon under Rs. 35 per ton (allowing Rs. 5 for profit), whereas Scotch coal is selling there at Rs. 18 per ton. By the amended estimate, the price of the former at Rangoon would be brought down to Rs. 22, but it would still be out of the market. There is certainly no immediate prospect of the coal seams at Thayetmyo being worked at a profit, and from all that is yet known of the quality of their outturn, there would seem equally little chance of their being so during this generation We shall try to find room for Dr. Robertson's Report in our November issue.

GOLD IN WYNAAD.

Note on the Progress of the Gold Industry in the Wynaad, Nilghiri District, Madras Presidency, by W. King, B.A., Deputy Superintendent, Geological Survey of India.

THE official boundaries of Wynaad having of late been altered by the annexation of its south-eastern frontier, or the country around Deyballah, to the Commissionership of the Nilgiris, it becomes necessary, as in the heading of this paper, to refer to the present area of the gold industry as being in the Nilgiri district, instead of as hitherto in that of Malabar.

It is now nearly three years since my first notice, was written on the goldfields of Wynaad, at which time a commencement was about to be made by the pioneer Alpha Gold Company in working them. Since then two other Companies, the 'Wynaad Prospecting' and the 'Prince of Wales Tribute,' have made essays with the same intention; but none of these have until very lately, succeeded in obtaining from the quartz an average percentage of gold at all equalling, that of my preliminary crushings, namely, 7 dwts. to the ton. It is only within the last few months that some stone from 'Wrights' level' in the Alpha works has yielded from from 1½ to 17 pennyweights.

The returns obtained were all so much below the amount expected, that I was, at various times, applied to by those interested in the successful working of these Companies for any suggestions as to improved manipulation, or better mining; and in July last I made a hurried inspection of the works and the machinery.

In all cases, the mining had only been carried on near the surface; and in most instances disappointing results had driven the managers and working

Directors from one point to another of the reefs, as more or less promising stone seemed to present itself to the search. The Alpha Company was at a standstill through exhaustion of funds and breaking down of machinery; the Wynaad Prospecting Company had nearly run through its capital, but hoped to be able to hold on by obtaining gold sufficient to pay working expenses; and the Prince of Wales' Company which has no machinery of its own, had leased that of the Alpha Company, and was collecting stone in readiness for crushing, as soon as this machinery should be again in order.

Through the kindness of the Managing Directors, I have been supplied with the tables and statistics given in this paper; and these will show what the results have been up to date. They do not, however, show how and whence the stone was obtained, or the style of machinery used; I therefore enter into some detail in this paper regarding these two points.

The main results of the gold workings up to date are, as nearly as can be made out—for no correct returns were kept at first—that the gross amount of gold obtained by the three Companies up to the 14th of March 1878, is 271 oz. 9 dwts. 14 grains: the average yield of gold per ton of quartz on all this amount has been 1·45 dwts.; and this gold has been sold at prices varying from Rs. 40 to 45 the ounce. This low average yield is calculated on the whole absolute tonnage of quartz extracted in Wynaad; but it is only fair to give the following averages for each Company's working:—

Alpha Company	769·5	tons gives	2·27	dwts.
Wynaad Prospecting Company ...	99·85	,, ,,	3·02	,,
Prince of Wales' Company ...	322·66	,, ,,	10·5	,,

Regarding the 'touch' of the gold, I have only two quotations from the Wynaad Prospecting Company, namely:—"It varies much in quality, running from 5¼ to 9; Mr. Orr, values the worst at Rs. 36 per ounce." Mr. Orr, whose firm of jewellers in Madras has purchased most of the Wynaad gold, writes me:—"The gold is of good quality, better than *sooga* gold,[*] for which we have paid Rs. 45 per ounce."

The country around Dayvallah is much broken up into low grassy hills and ridges, varying in height up too 300 feet, on the summits and crests of which the quartz reefs generally occur, and the valleys between these all lead into the great 2 000 feet deep Carcoor cherrum, or valley, of the Western Ghats, or into the smaller cherrums to the west of Dayvallah. The mines of the original workers, or the Korumber excavations, and even those of the latest European explorers, have all been run into the slopes of these small hills, or into the sides of the great cherrum; but very few of these have been driven at the lowest levels, or from the beds of the streams between the hills. Indeed, I doubt whether any workings have been excavated below the levels of these streams, except perhaps in the sides of the Carcoor valley; and there is no known instance of shafts having been sunk to the depth of the permanently water-holding country-rock, below that zone of variable thickness into which atmospheric influences are supposed to extend.

It is not here intended, after the popular cry, to imply that mining ought to have been carried to any extraordinary depths, such as the 7 or 800 feet levels of Australia, where working was in most cases only rendered necessary by the lodes having been worked out to those depths, nor is it an ascertained rule that richness of veins almost always increases with the depth; but is almost certain that displacement and non-continuity of reefs must be expected in so much of the country-rock as is exposed to atmospheric influences, and these defects would of themselves be sufficient to prevent steady and successful mining being carried on to any great extent at all near the surface. Local displacement can of course, as a general rule, only have taken place near the surface but as this surface in Wynaad is a very uneven one, such breaks must be expected in most of the ridges and knolls of the Dayvallah country, and to much greater extent on the great slopes of the Ghats. There is even a case in point in the Prince of Wales' Company's claim, where, on the east side of the ridge north of the Alpha works, a tunnel was driven with the expectation of cutting the northern course of the Skull reef on the prevalent eastward dip, but without success. It was then conjectured, from an outcrop of quartz on the south slope of this ridge, that the reef dipped quite in the opposite direction or westward, and a new tunnel was proposed.[†] The reef shows very well on the top of the ridge, lying at a very low angle to the eastward, but it has a tendency to resume the higher normal dip (25 to 30) lower down the slope. From all I could see, the very low dip on the summit of the hill appeared to be due to a sinking down of the reef on the weathered and denuded foot-wall, while the abnormal lie of the outcrops of quartz on the lower slopes is most likely attributable to local displacement of the country-rock, very large and old slides of decomposed gneiss being not at all unfrequent in this part of the country.

It has been found that the reefs continue to the deep so far as workings have been carried out, but as these are of little depth, the country itself can only be looked to for evidence of any value on this point. Certainly many of the reefs can, on the upland, be seen to run deeper than the Skull reef; while outcrops are known to exist far down in the deep Ghat valleys, which to all appearance are the continuations of reefs on the upland; and it seems hardly probable that reefs which are traceable for miles in their strike can be so be very limited in depth. There must no doubt, be cases of thinning out, and it may be so in the case in question to some extent; but the evidence is against this, for some part of the reef (slipped or *in situ*) has been struck in the last attempt to reach it; though, even if it had not been struck, there would have been no clear proof of its entire absence, considering that the tunnel has a much smaller section, and that reefs are often capricious within small ranges. But it is a most common experience in this part of Wynaad to find the reef outcrops much tumbled and slipped at various points among the ridges in the upland; and seeing that here, well up the sides of the hill in question, there are large outcrops of quartz in untoward positions, one showing a westerly dip, I am the more inclined to view the case as one of displacement in preference to one of sudden absence of the reef altogether over any appreciable area.

A further source of disappointment in the present system of mining may also, I think, be in a possible mechanical distribution of some of the gold irregularly throughout the reefs by the mere percolation of water in this zone of varied decompositions; and that thus the gold may be found not only more fitfully distributed than is at times usual with the precious metal, but even to some extent washed out of the reef. Although there is no certain evidence, that gold may be thus distributed through reefs, the possibility of such a mechanical process seems quite conceivable, when the conditions of some of the reefs, and their gold are considered in conjunction with the effects of such an exceptionally moist climate as that of Wynaad, where the movement of water under ground must be proportional to that on the surface. The quartz of many reefs, as far as is disclosed by the old excavations, and later [illegible] recent workings, particularly in the Skull reef, is much fissured and very often minutely, and even in part continuously, cavernous, or, again, quite crumbling and rotten from having been so largely charged with sulphides, while the gold left is generally in a minute state of division; and throughout this style of vein stone there is tolerably free percolation of water in quite sufficient force to carry off minute gold. In nearly all the old excavations which I examined, and some of these are at the base of the Dayvallah ridges, water was dripping freely from the exposed surfaces of quartz. Nearly all the long outcrops of the reefs are really just catch surfaces for water, while the reefs themselves and their clayey salvages must be, in many instances, only so many channels for the flow of water through the zone of decomposed rock. Among other modes of occurrence, the gold is found in empty cavities, once also occupied in part by sulphides, which have left their impressions on the quartz: or it is intimately associated with sulphides in partially filled cavities, or, again, it and the sulphides fill up such hollows. In the first and second cases, more or less sulphides have been removed, more generally by solution, but still to some extent mechanically, most likely as fine ochre. The gold associated with these, was then either left behind, as is often the case, or it might, if minute enough have been carried along with the solutions, or subsequently, by the ever recurring passage of water to be caught again in favourable hollows, or collected in and against the clayey casing,[*] or gravitated to the plans of constant saturation, or finally, carried out altogether by springs in the Ghats.[†]

With the possibility, then, of such a secondary distribution of part of the gold, and an extreme probability of encountering more or less disturbance of the reefs, in the ground within the reach of atmospheric influences it becomes an important question how far those influences may extend beneath the surface, or, in other words, at what depth the plan of constant saturation may be supposed to lie. It may, at all events, be concluded from the old excavations in the country-rock debris of which is still frequently found at their mouths, and from the lately driven tunnels which were mostly in tough clay (decomposed falspathic gneiss), that varied decompositions penetrate throughout a great portion of the upland country to the level of lowest drainage, that is, occasionally for 300 feet; and on this it is reasonably inferrible that weathering extends nearly as deep again in the neighbourhood of the main upland streams, and far inward horizontally on or near the edges of the Ghat slopes. Thus, arguing from the depth to which these influences extend on the upland, I should be inclined to look for the plans of constant saturation at 200 feet below and 600 feet inwards from the level of the edges of the Ghats. Further inland, the vertical depth might be taken at 100 feet.

At the same time it is, as has been shown by the late success of the Prince of Wales' Company, always possible that rich finds may be met with, the theory of fitful secondary distribution even meeting this view within the zone of variable decompositions; but these will be at the best but of importance in small adventures, such as those which have up to the present time been carried on in Wynaad.

The Alpha Company opened up a large quartz 'boil,' or massed assemblage of veins, called the Skull reef, not far from the site of their machinery, the stone having been collected partly from the surface, and partly from fresh excavations in the old mines of the Korumbers. An adit was run, without any careful consideration as to direction, into the west side of the hill, with the hope that the reef might be cut somewhere about the lowest level of the old Korumber workings; but this was abandoned after a time. This excavation showed, at any rate, that driving will not be a very expensive item in the gold industry, as the rock is very largely weathered into a soft more or less felspathic clay, with occasional masses of undecomposed rock; but timbering is absolutely necessary to guard against the very frequent slipping of this clay. Then, as there had always been a desire on the part of the manager (Mr. Withers) to drive at the southern outcrop on the steep slope of the Ghat, a tunnel was run in for a short distance at 'Wrights' level though still at a considerable height above the limit of permanent saturation and well within the range of atmospheric influences. It is, however, from the same Wrights' level that the rich stone worked by the Prince of Wales' Company was subsequently obtained.

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[*] Among native goldsmiths, there are ordinarily three qualities of gold, of which "sooga" is the medium.

[†] This was at the time of my visit in August last; but it appears that no further attempt was then made to strike the reef, all efforts having been directed to raising of stone from another more accessible part of the Skull reef. In the la[illegible] of the Company it is stated that another endeavour was made at the Prince of Wales' reef so late as the 1st of January 1878; but that as the old workings had completely fallen in, it was necessary to begin a fresh tunnel and that the reef was only struck ten days before their lease expired. The length of the tunnel is given as 132 feet from entrance and about 50 feet in depth from surface; but there are no further details [illegible] direction or position.

[*] The frequent richness of casing and wall-rock, though generally accounted for by chemical action, may be in part also due to this, as it were, secondary process of distribution; for there is free gold here, as well as in the veins

[†] For some interesting remarks upon the possible removal of gold by solution, see 'Raymond's Mining Statistics West of the Rocky Mountains" (1871), p. 508.

The want of succes in the operations of the Alpha Company may be attributed, I think in great part, to the following causes. First, bad selection of stone. That there is very good stone in the reefs of the Alpha concession is proved by the later crushings of the Prince of Wales' Company Second unsystematic working of the reef or reefs, as exemplified in the fitful manner of taking stone from open quarries at the surface and from the different drifts, according as fancy led the authorities Certainly better returns than those obtained might have resulted from one steadily-pursued tunnel and side galleries; while they could not have been worse than those got on the desultory plan of working. Third, the proper amount of stone was never either mined or crushed in the time estimated for a paying result. The engine was overestimated in its power, and the 15 stamps were never worked at once; while the calculation was that, with 15 stamps, 15 tons of quartz could be crushed in the day's work As it is, according to the returns supplied to me by the Alpha Company, I find that had their work been at the rate originally proposed, even under their small general average, the working of the mine would not have been a failure. The cost of raising and crushing 796½ tons of quartz was Rs. 2,971-0 5; and taking the value of their gold at Rs. 45 per ounce which is about what was paid for it, the amount realised on 91 oz. 12 dwts. 23 grains, or about Rs. 4,224-0-0, leaves a value of Rs. 1,252-11-0 for other expenses, besides raising and crushing. It is true that parts of eight months were occupied in this crushing, but the work ought all to have been done in two months and a half, reckoning 20 working days to the month; and had the work been properly done, it is almost certain that the cost of raising and crushing, would not have been so high as it is set down in their table, the average cost of raising and crushing the quartz being Rs. 386 per ton, a far too high rate for Wynaad mining.

The next adventure is that of the Wynaad Prospecting Company, which has been carried on in a very small way with the intention of making preliminary trials as to the paying capabilities of the reefs. The works are situated on the edge of the Carcoor cherrum, near the outfall of one of the minor streams of the Dayvallah country, so as to take advantage of the water-power, while the reefs worked are also close by. In the case of this undertaking also, the mining has not been systematic, nor has it been carried to any depth in the hillside or downward. Of the reefs taken up by this Company, the Monarch was tried by a shaft and level drift run into the eastern side of the hill through which the reef runs; but was given up at 55 feet, as the lode was not struck, as had been expected, if the dip of the reef had remained constant. Operations were then confined to the Hamlin, Bear, Korumber and Etacull reefs, where they crop out on the edge of the Dayvallah plateau, or at the top of the northern slope of the Carcoor cherrum, and where there is an extraordinary number of old shafts and excavations of the old gold-diggers. It was from among the leaders of these reefs, in the soft decomposed felspathic gneiss, that lumps of quartz with visible gold associated with nests of limonite were obtained.

The Prince of Wales' Tribute Company was started on a very small scale, perhaps more with the idea of keeping the gold industry before the public. The mines, machinery, &c., of the Alpha Company were taken on a tribute for a certain period, and operations were commenced with stone from the old quarries of the Alpha works. A commencement was also made on the northern extension of the Skull reef in a high hill between the works and Dayvallah village. but the excavations were stopped owing, as already stated, to the reef not being struck at the expected distance, though the search was afterwards resumed, and the reef found just before the lease had expired. However. a persistent drive at Wrights' level resulted in a find of rich stone, which continued to give good results, until March last, when the operations were discontinued.

The capital of the three Companies has thus been expended on what must be considered mere scratchings below grass, from which of course it was always possible that local rich finds might have been secured; as it is, no rich shoot of gold was struck until very lately, or until the capital and patience of the pioneer explorers was to all appearance worn out. It is evident however, from the latest reports of the working of the Prince of Wales' Company, that a rich vein has at length been struck, which may in its continued development fulfil all the promise of this new gold field.

At the Alpha works, there is a stamping apparatus of 15 stamps, arranged in three batteries of the ordinary kind used in Australia, whence this one was also procured. The batteries are driven by a 15 (nominal) horse-power locomobile, the fuel for which is obtainable in the forests close by. It is worthy of notice that this engine has never worked up to the power stated, various reasons being given for this, as that it was a second-hand English engine sent from Australia, or that the fuel was damp, both of which reasons are presumably fair. There is no doubt of the deterioration of fuel there being no sheds for its storage, as should be the case in a climate like that of Wynaad. However, I am firmly convinced that such a costly item as fuel, even in Wynaad, should never be included in a scheme for working the gold when there is water-power sufficient for the purpose.

From the batteries, the crushed material is passed over copper* tables, mercury troughs, and blanket tables, after which the tailings are treated in a pulveriser. It was found, however, that complete extraction was not effected in the pulveriser, or, as it might more properly be called, amalgamating pulveriser, for much float-gold and gold associated with sulphides, which ought to have been taken up by the mercury, passed away with the slime. A reverberatory furnace was than constructed in which the tailings were roasted and again pulverised, with somewhat better results; though even after this a perceptible amount of gold could always be shown by washing, and secured by hand-rubbing with sodium-amalgam. It was at the same time found, and experience in the other workings has since verified this, that sodium-amalgam should be used as much as possible, instead of simple mercury, in the extraction of Wynaad gold. In the pulveriser, the tailings are made to pass between the grinding wheels and the bevelled edge of the circular pan in which they revolve, while the mercury lies at the bottom of this edge, just below the grinding surfaces; and thus the slime and sand are only ground finer, and then brought in contact with the mercury by agitation alone, which is not sufficient for amalgamation from these tailings, considering that they are so largely made up of sulphides and other ferruginous impurities; while with this, the mercury is so liabl to "flour" and become granular, and thus incapable of taking up the minuter gold. Continued observation and experience show that a process analogous to hand-rubbing in the washer's dish is necessary for the saving of minut gold; hence the pulveriser should have the property of grinding the slime in intimate contact with the mercury, as in the ordinary 'arrastre, or else a rubbing apparatus should succeed it in the process of extraction.

At the time of my last visit, the Alpha works were at a standstill several repairs being in course of operation, and the engine waiting fo some fitting to the boiler. The manager, however, passed several sample of ordinary burnt tailings through the hand-process which clearly showe gold, only part of which was, however, taken up by even the sodium-amalgan and there was always colour of gold to the last of the rubbing.

The works of the Wynaad Prospecting Company are planted a short distance down the slope of the Carcoor cherrum, and a wire rope, some 1 feet long, is stretched from the entrance of the galleries to the works, alon which the baskets of vein-stuff are shot to a kiln, were the stone is bur prior to being the more easily broken up and tipped into the feed-bo The machinery consists of a Husband's pneumatic stamper, driven by turbine having a fall of about thirty feet of water, and capable of crushi half a ton in eight hours, the working of these being remarkably easy a constant, requiring only such care as a well-trained native and his assista can give. From the stamping box, the fine sandy slime passes over a seri of two amalgamated copper tables, with a mercury trough at end of eac whence it flows by a spout to the top of the hollow vertical shaft a grinding concentrator. The bottom of this shaft is screwed into a mull (continuously hollow with the shaft), or inverted truncated cone, revolvi inside of a fixed pan, the lip of which is level with the upper edge of th muller. After passing down the shaft, the stuff is ground only in a ve inefficient manner in the pan and then agitated, but not rubbed intimate with the mercury, which lies at the lowest level, or out of reach of th grinding surfaces. This defect might certainly be obviated to some ext by filling up the pan with a sufficient quantity of mercury; but this was found practicable at these works; indeed this apparatus was found to be so little use either in grinding or concentration, that its employment w discontinued. To a certain extent, as its name implies, this machine concentrator, for the gold and the auriferous sulphides must, perforce, rem at the bottom of the pan longer than the rest of the crushed material, wh is carried away by the water; and in this way freer scope is given amalgamating, but effectual amalgamation, as far as Wynaad gold is concern is not secured, by such poor grinding and agitation.

There is here, in fact, very much the same defect as in the Alp machinery; in both case there is a machine which was expected to gr and amalgamate, but the grinding is only well done in the Alpha pulveri while no effectual amalgamation takes place in either apparatus. From pan the stuff passes over a further copper table into a transverse tro with a further and last supply of mercury. A horizontal pipe, the und surface of which is perforated, runs along near the bottom of this troug water is turned on through the pipe with considerable force, and by rush among the materials at the bottom a violent agitation is caused, lighter sand is driven off, and a partial concentration is effected in con with the mercury. Beyond this, a further series of sloping bundles riffled troughs intercept the sulphides, until the tailings finally fall the catch-pit. Here, also, it was found necessary to construct a furn for the roasting of the tailings, which were again passed through whole process, commencing with the stamping box; the results were satisfactory, though the tailings clearly showed an appreciable quant of gold, much of which, however, could not be saved by the appara provided. As usual, hand-grinding and amalgamation give the b returns ; and thus it is evident that a rubbing machine * is required, in addition to a pulveriser. Two assays of hand-ground tailings from the reverberatory furnace were very satisfactory, giving averages of 1,166 dwts. and 6·12 dwts. to the ton. Such roasted tailings as I saw at these works were all so stony and slaggy, that they appeared to have been rather smelted than roasted, and were quite as hard as the original vein-stone. Authority on this point appears always to indicate a bright red heat as the limit of roasting, and that the roasted material can be broken up without such force being required as that of the stamper ; though of course it should be submitted to this, in order to reduce it sufficiently for the pulveriser. It is also advised† that the tailings should be freely exposed to the action of the atmosphere for some months in thin layers, and not piled up in pits, as is the case in the Wyanad works.

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* These tables were subsequently, as they should have been in the first inst. coated with sodium-amalgam.

The Prince of Wales' Company, as already stated, made use of the Alpha mill ; but fortunately the stone raised was rich enough to dispense with extraordinary care in the concentration and amalgamation, which hardly could have been arranged in the time allowed during the least, or with the small capital at their disposal. Under this administration it was found that the working-power of the driving-engine was only sufficient for the crushing of seven tons per diem, or about half the rate originally calculated on.

The following tables are from the published returns of the Companies or from returns which have been supplied to me by the Managing Directors and, from my personal knowledge of all the gentleman concerned, I believe that they have furnished these returns with a firm determination to let the true tale of their efforts be known. Until lately, all these efforts have been unattended with the success they deserved, and no gain has been made except by the latest adventure, which has had the enormous advantage of working with machinery ready at hand. So far, the work of the latter Company has been crowned with what may be called a success ; for, in November last, 50 tons gave an average of over 11, while. in December 50 tons gave an average of 17 pennyweights, thus showing a decided tendency in the quartz to come up to my average, if not to exceed it.

In the beginning of this paper, the average percentage of gold is given for all the quartz crushed, which is really the truest test of the capabilities of a gold-field ; otherwise, between isolated and short operations of particular adventures, where can a line be drawn from which an average should be reckoned ? But this generalisation for a whole field is obviously unfair to an adventure which has given averages, for large quantities of stone, exceeding those attained in the earlier trials. I would therefore here record a few data regarding the operations of each of the Companies, collated from their tables so that the good points in each may be calmly weighed against the general average referred to.

The Alpha Company crushed, in about eight months, only 769·5 tons of quartz at a cost of Rs. 2,971-6-0 for raising and crushing, and obtained 91 oz. 12 dwts. 12 grains of gold, giving an average of 2·27 dwts. This work, according to the original estimate of 15 tons per diem, ought to have been done in two months and a half, reckoning 20 working days in the month.

The Prospecting Company crushed 99·85 tons, cost not given, in about eight months, and obtained 11 oz. 19 dwts 19 grains, or an average of 3 dwts. At half a ton a day, the working-power of their stamper, this is a fair rate of work.

The Prince of Wales' Company crushed 322 66 tons in a little over six months, cost not stated, and obtained 161 oz. 17 dwts. 6 grains of gold, or an average of 10·5 dwts. Such work ought to have been done in a little more than a month with the Alpha machinery at the originally estimated rate.

The average cost of raising and crushing one ton of quartz by the Alpha Company was Rs. 2 and Rs. 185 respectively. Under the Prince of Wales' Company, the charge for mining was Rs. 415, and supposably the same rate for crushing as with the Alpha. In both cases, these rates are far too high. No returns have been supplied as to these charges with the Prospecting Company ; but, from the experimental way in which the trials were made, the cost of raising was probably higher than in either of the other adventures, while that of crushing must have been proportionally low, considering that water is the motive power employed.

In all cases, time has been the most expensive item , the charges for superintendence, pay of engine-drivers, permanent hands, and live-stock are far beyond any estimate which might have been proposed. For instance, in the account of expenditure of one Company, the charges for these amount to Rs. 3,942-12-10 in nine months, when the whole transaction, if properly organised and systematically carried on, even allowing for the delay consequent on putting the machinery in order, should have occupied, at the most, only half this time.

TABLE I.

Memo. of eight months' cru[illegible]ng, Alpha Gold Company Limited.

MONTH.	Quartz crushed.	Total yield.			Average yield.			Cost of raising.			Cost of crushing.			TOTAL.		
1875.	Tons.	oz.	dwts.	grs.	oz.	dwts.	grs.	Rs.	A.	P.	Rs.	A.	P.	Rs	A.	P.
September ..	99	8	12	0	0	1	17	172	0	0	126	1	6	298	1	6
October ..	40	8	0	0	0	4	0	176	9	6	17[illegible]	15	6	347	9	0
November .. December ..	269	24	5	12	0	1	19	291	11	0	314	2	6	606	1	6
1876.																
January ..	175	22	11	0	0	2	14	293	4	6	269	0	0	562	5	0
February ..	170	17	12	10	0	2	1	328	8	0	368	3	0	696	11	0
March ..	29	3	19	15	0	4	0	182	5	0	116	8	0	298	8	0
November *	6½	6	9	10	0	19	22	97	2	0	65	0	0	162	2	0
TOTAL ..	769½	91	12	23	0	2	9	1,541	11	0	1,429	11	0	[illegible]	6	0

* Crushed at the works of the Prospecting Company.

TABLE II.

Memo. of crushings, Wynaad, Prospecting Company's Works.

No. of trial.	Date of cleaning up.	Weight of stone crushed.			Yield of gold.			Rate per ton.			REMARKS.
	1876.	Cwt.	qrs.	lbs.	oz.	dwts.	grs.	oz.	dwts.	grs.	
1	5th October ...	44	0	0	0	9	17	0	4	10	
2	30th „ ..	420	0	0	2	17	21	0	2	18	
3	11th November..	500	0	0	3	6	6	0	2	15	
5	29th „ ..	185	0	0	0	9	4	0	1	0	Not passed through amalgamator.
6	4th December .	35	0	0	1	3	1	0	16	0	Picked stone; cost Rs. 15 per ton.
7	23rd „ ..	350	0	0	0	16	16	0	1	0	Not passed through amalgamator.
8	28th „ ..	40	0	0	0	4	3	0	2	13	Stone rejected in trial No. 6.
	1877.										
9	6th January ..	175	0	0	0	8	13	0	1	0	Not passed through amalgamator.
10	9th April ..	150	0	0	0	2	6	....			Hand-ground; burnt tailings.
11	21st August ..	140	0	0	3	15	0	....			Mr. Withers' work and selection.
12	25th September..	91	0	0	0	9	16	....			Tailings from No. 11 not burnt.
13	14th October ..	108	0	0	0	19	12	0	3	15	Jacob, Carpenter's work; cost Rs. 7 per ton.
		1,997	0	0	14	19	19	0	3	0	

TABLE III.

Memo. of assays, Wynaad Prospecting Company's Works.

ASSAYS OF TAILINGS.					ASSAYS, VARIOUS.				
Weight.	Yield per ton			REMARKS.	Weight.	Yield per ton.			REMARKS.
lb.	oz.	dwt.	grs.		lbs.	oz.	dwt	grs	
22	0	6	7	Catch-pit, not burnt	112	0	9	0	Average of 200 ton heap, English assay.
12	0	3	21	Catch-pit, burnt ..	0	0	0	0	
10	0	4	20	Blanket, not burnt	10	0	9	8	Same stuff, Withers' assay
10	0	4	18	Bundle, burnt ..	10	0	2	9	Same stuff, Korumber's assay.
40	0	11	16	Reverberatory furnace, hand ground	5	1	3	0	Korumber's assay, Bear reef No. 2.
112	0	3	8	Reverberatory furnace, not ground	5	0	10	0	Korumber's assay, Bear reef No. 1.
112	0	6	[illegible]	Reverberatory furnace, hand ground	18	0	2	12	Korumber's assay, sand from trials.
1	0	1	7	Blanket tailings, English assay ..	[illegible]	2	5	0	
1	0	1	5	Catch-pit tailings, English assay ..	27	1	0	0	

TABLE IV.

Memo. of crushings, &c., Prince of Wales' Company Limited.

MONTH.	Quartz crushed	Total yield of gold.			Average yield per ton.			Total cost of mining.			Average cost of mining 1 ton.			Average cost of crushing 1 ton.		
1877.	Tons	oz.	dwt	grs.	oz.	dwt.	grs	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
August 17th September . October 1st .	101·66	14	10	0	0	2	18½	362	7	0	3	7	8	1	13	9*
November	12·00	1	6	12	0	2	5	310	13	6	5	0	2			
Ditto	5·00	20	9	0	0	11	1[illegible]									
December .	50·00	41	6	0	0	16	12 25	926	12	6	5	14	8			
1878.																
January .	104·00	77	9	18	0	11	21 6									
February 22nd	2·00	0	16	0	0	8	0									
TOTAL ..	[illegible]2·06	164	17	6	0	10	12	1,600	1	0	4	15	4	1	13	9*

		Oz.	Rs.	A.	P.
Specimens of gold in quartz sold in November, about	..	4·35	175	0	0
Ditto ditto December, „	..	4	156	4	0
Ditto ditto Jany. & Feby. „	..	23	920	0	0
Average price of gold from crushings per ounce	..	..	41	10	8

* Presumed average, taken from Table I, of Alpha Company's results.

THE WYNAAD GOLD COMPANIES.

THE Wynaad Gold Prospecting Company, Limited, have completed arrangements for the transfer of mining concessions to Messrs. W. Nicol and Co., of Bombay, and that this firm have undertaken to commence prospecting operations with as little delay as possible. The Prince of Wales Company are also in negotiations with the same firm, to transfer their mining rights on similar terms, while it is reported that active correspondence is going on between Messrs. Parry and Co., Secretaries to the Alpha Mining Company, Limited, and Messrs. W. Nicol and Co., with the same object. Large concessions have also been obtained by Messrs. W. Nicol and Co., from the Rajahs of Nellumboor and Nelliallum. We may therefore soon see preparations being made for a thorough exploration of the country

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* Such a machine is described in the last edition of Raymond's Min[illegible] [illegible] States West of the Rocky Mountains.

† Quartz Operator's Hand-book, Randall, New York, 1871

The Planters' Gazette.

TEA.

An area of not less than two thousand acres, Mr. Robertson calculates, is now under tea cultivation in the Neilgheries, a hybrid between the China and Assam varieties having been found by experience to succeed best there. Most of the Neilgherry tea plantations are on what were once grass-lands, though experiments with the plant cultivated on *sholas* have subsequently showed that the former description of land can be rendered, by judicious management, quite as productive as shola lands, which are more costly. Started as mere experiments, the tea industry of Southern India soon attained considerable dimensions. The "unblushing individual" who inflated his "bubble" of tea cultivation in India, must regard with superlative satisfaction, if he be still living, Mr. Robertson's narrative of the prospects of tea cultivation in this country. The returns of the leaf under high cultivation promise to be still more encouraging than they have yet been. "Nothing," Mr. Robertson says, "is more simple than the production of the leaf"; nothing, we would add, more encouraging than the success which has, up to this day, marked the cultivation. Mr. Robertson believes that if tea-planters would but combine to raise a capital for the establishment of well-conducted and scientifically directed factories in each centre of the tea-producing districts, great failure would not occur, and the difficulty experienced in carrying the leaf to the curing houses, at inconvenient distances from the plantations be overcome. Tea grown under the suggestions Mr. Robertson proposes, will possess that uniformity of quality, which it now wants sometimes, and thus be able to command a still higher position in wholesale markets than it now does. One such factory would be worked at far less cost than the ten or a dozen isolated tea houses, which it would soon displace. The co-operative system, he thinks, tried and proved to be so successful with cheese and butter in some parts of England, must be equally successful in dealing with tea; indeed, he goes on to tell us that it has begun to be a custom with some few estates to sell all the fresh leaf produced to some neighboring planter, who pays for the leaf at the rate of two annas per pound, and manufactures it along with that grown on his own estate. Mr. Robertson is no less earnest on the subject of manure needed for remunerative tea cultivation than he is with every other division of labor required to prosecute it to satisfactory issues. The planter has "more unemployed labor about him sometimes, than he knows how to direct usefully," but by combining farming with tea culture, a full command of both labor and manure will be always within reach, and he will be in a position at all times to employ his men, throughout the year, whenever there is a flush of leaves to gather in. The raising of grain and root crops for the use of both men and cattle will have a double advantage. What the cattle consume, they will return to the soil; what is expended on the men, will keep them always at the planters' command, always ready for any description of labor they may be called upon to give.

The Tounghoo correspondent of the *Rangoon Gazette* says that in 1876 the late Assistant Commissioner of the Salween Hill tracts tried the cultivation of tea in those hills. He looked upon the experiment as a failure, as there was no sign of any of the plants coming up. About the beginning of the year the present Assistant Commissioner discovered to his surprise that hundreds of tea plants were growing wild in the locality where the seed had been sown.

"Sundry patches of jungle have been opened lately in our neighbourhood for the cultivation of tea," says a correspondent in the Wynaad, "and this suitable weather utilized by putting out the young plants. There seems to be more feeling now in favour of tea-growing in Wynaad than formerly. Indeed, the idea generally seems to be that it is as well to have many strings to one's bow; and our estates are no longer coffee, and coffee only, but cinchona, and tea, and where nothing else will grow, guinea grass; a better plan, we think, than the desolate patches of 'abandoned land' which ld days became a prey to wild brinjals, and l'antana, instead o dding their mite to our profits in the shape of sturdy cinchonas, or ht fields of fodder, which help the cattle so well through the dry ons."

A rather extraordinary discovery has, accordin newspaper, been made in the neighbourhood of Tr Turkish species of tea shrub much resembling that which grows of a It is stated that enormous quantities of this tea have been bou up by Persian merchants and sent to Persia, where it seems this new product is appreciated almost as highly as the genuine article. The method employed by the peasants in preparing it, is very primitive, and consists merely in picking the leaves and drying them in the sun. It is then sold for about seven piastres the pound.

It may not be generally known that about 35 years ago, tea of the China variety was planted in the Pussellawa district, in Ceylon and Chinese were employed to prepare the tea. These men positively declined to allow the *modus operandi* to be watched, and this alone prevented its further growth and preparation, or ere this Ceylon would have had as many acres in tea as in coffee.

GEOGRAPHICAL DISTRIBUTION OF THE PLANT.

At the meeting of the British Association at Dublin on August 20, Mr. A. Burrell, M.R.A.S., F.S.S., of London, read a paper on "The Geographical Distribution of the Tea Plant." Tea, as a beverage, was known in Europe in the beginning of the sixteenth century, became a regular article of consumption in the seventeenth, formed one of the largest imports from China in the eighteenth, and was now the special beverage of all English speaking peoples, both in the New World and the Old. The botany, method of culture, and modes of manipulation were, however, little known here till about forty years ago. The Jesuit missionaries in China and Japan were our first informants of the virtues of tea. The Portuguese and the Dutch, who, long before our East India Company was established, traded with these countries, introduced it commercially to Europe, and there was evidence of its use in England in 1610, during the reign of James I., possibly introduced by hi Portuguese Queen. Dr. Johnson was quite wrong in dating its introduction after the Restoration, for it was in common use during the Commonwealth and the first Act of Parliament when the "King cam to his own again" was passed to levy a heavy duty on tea. Olive Cromwell's teapot, which the elder Disraeli had heard of, had no turned up, and there was no doubt but it was a favourite beverage of th Roundheads, and so hated by the Cavaliers, who were more given t wine and other potent liquors. The tea plant at first reached Europ in 1763, when the great botanist, Linnæus, received a seedling whic however notwithstanding the most assiduous care soon perished. Th earliest plant that had really flowered and produced seed was at Zio House, near London, in 1768. In China the tea plant was in commo use from the 7th century, in Japan from the 8th. It grew in the countries between 40 and 42 degrees of North latitude, and was capab of being grown as far of South latitude, though the best tea w produced in China between 27 degrees and 30 degrees North latitud Up to the first quarter of the present century all the tea consumption the world was supplied from China, with very little from Japan. 1827 the culture was introduced by the Dutch in Java, and has ev since proved a successful undertaking. In 1834 immediately after t abolition of the East India Company's monoply of trade to the East, t was introduced from China into India, not at first becoming a profitab undertaking. But next year the plant was discovered growing wild Assam. Mr. Burrell here described the history of this important di covery, and paid a well-merited compliment to Dr. M'Clellan the only survivor of the group of eminent men, scientific and practica who inaugurated what has since proved to be one of the great staple industries of India. Tea both from the China plant and fro this Assam kind, was now grown throughout all India, and w the result that, for variety of strength, pungency, and flavour, our gr dependency was now producing tea which China, in her more pal days, and less so than ever now, could not rival, and that great a growing as the demand was, India, throughout the vast extent a variety of her soils and climates, was destined to be the great t producer of the future. He adverted to the fact that, beginning with production of only 4lbs in 1840 she now sent into this country 4 millions of pounds—as great a quantity as was consumed in the who of the United Kingdom in 1837. The author then took up t

These were :—in Asia, distribution of the tea plant in other countri[illegible]va, and Burmah, where the the Corea, Tonquin, Cochin China, Anna[illegible] only for native consumption. tea plant was cultivated to some exte[illegible]827. The French had attempted It had been introduced to Brazil [illegible]s now growing in Mauritius, the its cultivation in 1841, [illegible]ia, at Singapore, in Ceylon and our Isle of France, St. [illegible] the West India islands it had also been Australian Colonies and the recent report of Kew gave a good account recently introd[illegible] Jamaica. Nor had our American cousins neglected of its condi[illegible] sent to China in 1857 for plants, and tried the culture it. Th[illegible]ington, in Virginia, and Carolina; quite recently they have [illegible] it in California, and near Baltimore. In fact the plant would grow anywhere in a temperate climate; would suit Ireland well, or Southern England, but the great difficulty in all these countries was the excessive cost of labour compared with China and India. Lastly, Mr. Burrell took up the question of the original home of the tea plant. In Japan it was admitted on all hands not to be indigenous. In China it was long held to be native to the soil, but more recent researches have thrown doubt on this point and the balance of evidence seems to point to the Assam Valley of India along the course of the Brahmapootra as the original seat of the plant. This is supported by the fact that, while in China the tea plant is never found thoroughly wild away from man's habitation, and is more of a herb than a tree, in Assam, on the other hand, and in the hill ranges surrounding that valley, it is found everywhere growing wild, and attaining great height as a tree, usually 15 to 20 feet high, and even by a report just received from India, 60 to 80 feet high, and of the girth of 3 to 4 feet among the secluded Naga hills. Mr. Burrell finished by citing from a variety of recent travellers in the vast stretch of country intervening between the frontiers of India and China, and on either side, evidence of the tea growing wild, and constantly of smaller dimensions as it approached to China, thus affording ground for his contention, which was further supported by the legends of China and Japan, that the tea plant was introduced there by a Buddhist missionary from India.

A discussion ensued, in which Sir George Campbell, M. P., E. W. Cooke, R.A., F.R.S.; Mr. Marcus Moses, and other gentlemen took part. At the end of the proceedings Mr. Burrell invited all the ladies present, and as many of the gentlemen as could be accommodated in the adjoining committee room to partake of a service of Indian tea. Mrs Burton, the wife of the great traveller, presided, assisted by several other ladies and gentlemen, about 100 in all, at a handsomely decorated table, where the tea was served in the best style, and gave the most perfect satisfaction, the fact that Indian tea could be so delicate in its flavour while abundant in strength being new to most of the guests.

The business of the section was brought to a close by Sir Rawson Rawson, who took the chair, and thanked the secretaries for their exertions during the sitting of the Association.

FERMENTATION OF TEA.

UPON this subject Mr. C. E. M. Russell writes as follows to the *Tea Gazette*,—

Mr. Lepper writes under the above heading for your issue of the 7th instant, asking for a chemical explanation of the organic metamorphoses which take place after the plucking of the leaf of tea, and which are commonly and collectively designated under the title '*fermentation*,' the propriety of which term, as applied to the changes taking places in rolled leaf of tea, Mr. Lepper is inclined to question.

As far as my limited knowledge of the subject will carry me, I see no reason whatever to doubt the propriety of the term, for the primary processes necessary to the fermentation of all fermentable matter do undoubtedly take place in the leaf of tea after rolling, though they are checked before true fermen[illegible]ion has been effected. Mr Lepper is quite right in supposing that the change of colour which takes place is one of the symptoms of incipient decay but, then, what else is fermentation? While an animal or vegetable organism is possessed of the mysterious and indefinite principle which we term *life*, it can undergo in its structure only such chemical changes during health as are appointed by nature for its well-being: should any external or internal cause give rise to an altered condition, disease, and ultimately death, will be the result. As soon, however, as death ensues in the whole or a part of any such organism, the chemical changes incident to decay at once commence to reconvert its whole or the part thus visited into the earth and air from which they had their origin.

In the operation of rolling, the *cellulose* which forms the skeletons of the leaf-fibres is fractured and thoroughly brought into co[illegible] with the expressed sap contained in the leaf,—now a dead vegetable product, with its parts more or less disintegrated and exposed to the oxygen of the atmosphere.

Now, the sap of plants contains dilute acids as well as alkalies in solution, and *cellulose* is soluble in dilute acids and alkalies.

The first chemical change that takes place is the conversion of the *cellulose* (which is identical in chemical composition with starch) into *glucose* or grape sugar. The chemical formula showing this change is,

$$C_6\ H_{10}\ O_5 + H_2\ O = C_6\ H_{12}\ O_6$$

Cellulose + water = glucose or grape sugar.

At this stage a high temperature and an expulsion of water by heat will stop the process, which, if it be allowed to proceed further, will, by a change set up by vegetable spores, ever present though invisible in atmospheric air, further convert some of the *glucose* into *alcohol*, the chemical formula being,

$$C_6\ H_{12}\ O_6 = 2\ C_2\ H_6\ O + 2\ C\ O_2$$

1 of glucose = 2 of alcohol + 2 of carbon dioxide.

The conditions necessary to fermentation are *heat* between certain degrees, *moisture* and *oxygen*.

Fermentable liquids, unless exposed to the action of air containing *oxygen*, will not ferment. The ranges of temperature between which fermentation takes place most readily are 20°–40° C. Hence the influence of the temperature in effecting rapid or slow fermentation, as the case may be.

In the baking of bread and in malting, we have familar instances of the changes above mentioned. In the former the lightness of well-baked bread is due to the evolution of the carbon-dioxide gas formed with alcohol from the glucose, which is itself formed from the starch contained in the flour. In malting, the change of starch into sugar is well marked; for the manufactured malt contains *four times* as much sugar as is found in the raw grain of barley.

If experience does not lead me into error, I should imagine that the object of fermention is to effect this conversion of *cellulose* into *glucose* and that the process should be stopped before there is any danger of the *glucose* thus formed being metamorphosed into *alcohal* and *carbonic acid gas*.

The sweet smell of fermenting leaf is evidently due to the *glucose*, which has been formed, and I have somewhere heard or read, the smell in the tea-house when tea has been over-fired or burnt, compared to the odour emitted by burnt sugar.

TEA AND COFFEE SUBSTITUTES.

(*Extract from the Rep[illegible] on Kew Gardens for* 1877-78)

DURING the [illegible]ast year several vegetable products coming under this designation have found their way into commerce, and have been brought under my notice.

1. "*Broussa Tea*"—Mr. George Maw informs me that this has become within the last few years a regular article of commerce, and is sold at from 30 to 60 piastres the oke of 2¾ lbs. From specimens of the plant producing it, obtained by Mr. George Maw, it was identified with *Vaccinium arctostaphylos*, a shrub abundant on the Bithynian Olympus, where the leaves are largely collected. They are gathered in spring, and after being laid in the shade on a straw mat, are rolled in the hands and dried by a slow fire in an oven They are said to make a very palatable beverage.

2. "*The Arabe*"—M. Durando has forwarded to Kew a packet of this material such as are offered for sale by Algerian pharmacists. The tea itself, whatever may be its medicinal merits, is not reported upon very favourably, though apparently enjoying considerable local reputation. It proves to consist of a mixture of the flowers of *Paronychia argentea* and *nivea*. The name "the arabe" is also given to infusions of *Globularia alyssum*, *Sistus albidus*, and *Aloysia citriodora*. The peronychia tea is distinguished by the name of "Sanguinaire."

3. *Coprosma Coffee.*—Mr. J. C. Crawford has recommended to the Wellington Philosophical Society the use of the berries of *Coprosma baueriana*, a New Zealand shrub not unfrequent in English gardens, as a coffee substitute. The usefulness of a product of this kind from a temperate climate is so manifest that the suggestion deserves a trial.

4. "*Negro Coffee.*"—The Commissioner of Customs forwarded to me in the early part of the year a sample of an article imported at the port of Liverpool from Bathurst, River Gambia, under the above name. They were identified at Kew as the seeds of *Cassia occidentalis*. According to Livingstone these are used, under the name of "Fedegozo seeds," on the Zambesi as a substitute for coffee. Monteiro, however, states in his "Angola and the River Congo" (vol. ii., p. 219), that Fedegozo seeds are used only medicinally as a substitute for quinine. "The seeds are roasted and ground and their infusion taken either alone or generally mixed with coffee."

IN THE NORTH-WEST.

THIS promises to be a very favourable season for tea, both in Kumaon and Gurhwul. The rain after the first onset when it was excessive in its fall has been moderate in quantity, and falling as a rule at night, followed by warmth and sunshine has been very conducive to heavy flushes, so it is confidently expected that 1878 will in a great measure make amends for the unfavourable season of 1877.

Black tea is still being made as a rule, the quantity of green tea made will not exceed 100,000lbs. this season, whereas in former seasons it used to come up to nearly 5,000,000lbs. Prices have fallen nearly 25 cent. from what cause it is difficult to say, unless it be that the acute green tea brokers see the brokers reports of the black tea sales in Calcutta, and shape their prices accordingly.—*Delhi Gazette.*

COFFEE.

IN planting Liberian coffee, the difficulty seems to be to secure plants in sufficiency. In Ceylon, says a correspondent, there has been a very large importation of seed, both cherry and parchment, but the attempts to germinate and grow them have been miserable failures. "There are about 14,000 to 16,000 seeds in a bushel of cherry, and of the half-a-dozen growers, I know a few succeeded in germinating from 20 per cent. to 10 per cent. One of these gentlemen startled us by saying his were springing up like French-beans! Three of us paid his beds a visit and found them imposing enough, but when we took to counting the plants, found that he had 2,000 odd from three bushels of cherry! The fault lies in the so-called seed coffee being picked green and half-ripe. They are very carelessly packed in strong soil in boxes, with miserable little holes for ventilation. The proportion of green seed was very large—three days' soaking did not help to remove with a blunt knife the pulp—those are really totally useless seed."

AN objection was lately urged against the introduction of the Ceylon coffee plant into the Neilgherries. The planter referred to said, that it was believed that the Ceylon plant was short-lived. Such does not, however, appear to be the case if what a correspondent remarks on the Bellwood Estate in Ceylon are correct: "Bellwood, in Hewaheto, the property of the heirs of the late C Brown, has been sold to Mr. Murray, late of Letchmine estate, Hunasgiriya, for £15,000. There are 300 acres under coffee, and the estate, though over 30 years old, has been well kept and has borne fair average crops. The estate was opened in 1845, by Messrs. Robert St. John Shaw and Emerson, was subsequently sold to Mr. John Northway, and by him again sold to Mr. C. Brown. Curiously enough, Bellwood was left out, or rejected, by those who opened the surrounding estates when they were lotted off, as *too steep* and too stony, and now the place can bear comparison with the best of them."

THE *SAVANTS* ON LEAF DISEASE.

City Chambers, Railway Place, Fenchurch Street,
London, 14th June, 1878.

The Secretary, Planters' Association,
Kandy, Ceylon.

Dear Sir,—I enclose for your information copy of a letter that will no doubt be of interest to your Association. I have applied to the Secretary of the Linnean Society for further information on the subject. Some of the statements made at their meeting would appear to be open to correction.

I am, &c.,
(Signed) WM. MARTIN LEAKE.

[Extract from letter dated 10th June 1878, referred to.]

My dear Sir,—Having a spare moment, I am able to tell you now all I know of the communication of the Revd. Abbey of Ceylon read on Thursday at the Linnean Society. He stated that a fungus had appeared there within a recent period which developes first on the underside of the leaf, but soon becomes implanted in its tissue, and continued to grow until the whole foliage was involved, destroying ultimately the life of the trees.

This fungus he had very carefully studied, and had on the walls a great number of drawings illustrative of a history and progressive development. He stated the practical results to be that while the average production of coffee per acre had been 4 cwts. and over, this had fallen already to 2·9 cwts., involving an annual loss of about two million pounds sterling.

Thus in 1871, when the pest first appeared, the product was £15,000,000, and it fell next year to £12,000,000. Nothing is known of the origin of this pest. He described an apparatus for its development from the diseased leaves, by which means he had been able to study it carefully. After Mr. Abbey's paper, Dr. Hooker's son-in-law, the curator of Kew (I forget his address at this moment), rose and confirmed the statement of the author, and said that the culture of coffee in Ceylon was practically at an end and that tea, cinchona and the cocoanut were taking its place. You can from the Secretary of the Linnean Society and from Kew obtain much more full data I am sure. I should say that Dr. Hooker's son-in-law stated in the same connection that in the New World the "Whitefly" had proved to be as great a damage to the coffee of Brazil and the Antilles as the pest in Ceylon. Certainly the subject must be considered as one of the greatest importance and will undoubtedly have your attention."

City Chambers, London, 21st June, 1878.

The Secretary, P. A., Kandy.

Dear Sir,—I annex extract from another letter received from the same writer as before, in regard to leaf disease. Mr. Owen will, I believe, call on the Secretary of the Linnean Society, and get all information as to what passed at their meeting.

I am, &c.,
(Signed) WM. MARTIN LEAKE.

The writer of the letters sent is an American Professor.

[Extract from letter dated 17th June, 1878, referred to.]

"In the Museum at Kew, I saw yesterday specimens of the work done by both the Ceylon fungus pest (*Hemileia Vastatrix*) and the insect (*Cemiostoma Coffeelatum*) or coffee-fly of America, in destroying the foliage of the coffee tree. Mr. Dyer (Assistant Director), thinks the result will probably be very disastrous to the Ceylon plantations; altho' the trees recover, and put forth a new crop, yet the strain on their vitality is very severe, and must ultimately tell, like repeated attacks of gout, for example, on the life of an organism.

You will find in the report of the Royal Gardens at Kew during 1876, an interesting statement by Sir J. Hooker, on the spread of the coffee disease. The information is more recent than its date on the cover."

There is some outrageous error in the report quoted by Mr. Leake of the Rev. Mr. Abbey's paper on leaf disease. The fungus first appeared on coffee estates or at any rate first attracted attention in 1869. By 1871, no doubt the evil effects of this minute vegetable plague became apparent in lessened crops, but we can make nothing of the figures attributed to Mr. Abbey, indicating a fall in value from £15 000,000 to £12,000 000. If we correct the sign for pounds into that for rupees, than the valuation of Ceylon crop is as much too law as the other is too high, and in no respect do the figures suit quantity even in pound—Mr. Abbey takes a gloomy view of coffee in Ceylon and as for Mr. Thiselton Dyer he has in the notes of science sung its funeral dirge The contrast between the vaticination of the savants and proceedings of planters and capitalist who ought, (the latter classes) to know what they are about, is very striking and we think very hopeful. Our strong impression is that the insect plague in Brazil came and did much damage but has not killed the coffee. The case of Dominica, where coffee was allowed to die out, because, deprived of labour, the planters could not help themselves, presents no analogy to ours. We have and are getting facilities to combat leaf disease, and it will go hard if human intelligence and human energy are beaten in the contest. Planters and capitalists have not anticipated and do not believe in such a result, and surely they, with their experience, observation, and personal interests, are safer guides, than speculative men of science. Coffee in Ceylon is not dead yet. It means to take a new lease of life.—*Ceylon Observer.*

Ceylon, 1st Sept. 1878.

LEAF-DISEASE and its ultimate effects are the prominent topics at present in planting circles; the scientists have lately been discussing it, and little comfort they give us either of its removal or mitigation. The devil is, however, not so black as he is painted, and the distinguished botanists who have made the *Hemileia vastatrix* their study and subject of discussion, have not a little departed from the true scientific spirit, which insists on proof for everything, when, in their efforts for effect, and to deepen the shadows of the already gloomy enough state of things they have gone in extensively for "piling the agony." That leaf-disease destroys "ultimately the life of the trees," and that "the culture in Ceylon is practically at an end," are statements which do not contain any basis of truth, and yet were promulgated at a meeting of the Linnean Society in London. Things are bad enough without being made worse, for our scientific authorities here are full of the gloomiest apprehensions, indeed it is years since the Directors of the Peradenia Botanical Gardens foresaw the state of things into which our enterprise has now unhappily fallen. Still the statements of the scientists at the Linnean Society ought never to have gone forth unless they could have been substantiated, and that they cannot be. There is no denying, however, that we have fallen on evil times. At present the disease is horribly bad, and, in passing through some fields of coffee, you come out almost as red as a bricklayer, so dusted are you all over with the spores of the fungus. In many cases there is not a leaf left, and the coffee has already begun to blacken at the points. The trees without crop are not much better, and students of the nude could now study to perfection the form and curvature of the most umbrageous coffee trees. The planters, seeing such destitution and want of common decency on the part of our staple, are heartily ashamed of the present state of things. The *Observer* lately suggested that the time had now come for a reward to be offered for a successful cure, and I certainly hope that this suggestion will be carried out. As it is, almost every conceivable thing has already had a trial somewhere or another, and every fresh nostrum is believed in, *until* it is tried. I heard the other day of a proprietor at home who had laid the matter before a scientific manufacturing chemist, and he has now got a manure which is intended to give extra vigour to the leaves, but if the scientists be correct, and the whole plant is affected, a more vigorous leaf will mean a more vigorous fungus, having more to feed upon. Others have gone in for bellows with nosels of a fan shape, which are intended to scatter sulphur upon the underside of the foliage of an affected tree with the hope that what was so successful with the vine may also be a cure for the coffee. Others, again, have salt, which was said to have destroyed the rust on the wheat, one of the fungus family, and a highly imaginative Irishman poured castor oil round the roots of his plants, for, as he said, "the trays may only want a physicing after all." Last of all, the irate Mr. Montelar has arrived in this land, bringing with him his plan for curing leaf-disease, his lucid view of the action of endosmose and exosmose, and doubtless many other novelties besides.

The difficulties of finding a remedy are doubtless very great, but I would not say insurmountable. When you remember that, in all likihood, there is not a tree or seedling in the island which is free from the pest, it would be a gigantic work to apply a cure even if a cheap one were discovered. We all hope for the best, however, either in the shape of a cheap and easily applied substance, or, better still, some climatic effect to rid us of the pest. While I am writing, my copy of the *Observer* is handed in, and I see by it that the Chamber of Commerce at Colombo are going to have a Special General Meeting to consider the utterances of the scientists, mentioned above. Mr. George Wall, the chairman, is to propose the following resolution:—

"The attention of the Chamber having been called to certain statements which have been lately published in England by distinguished scientists to the effect that 'leaf disease' has practically brought the cultivation of coffee in Ceylon to an end, the Chamber regards it as a duty to deprecate such statements, as being opposed to the facts of our knowledge and experience, and calculated to excite undue alarm in the minds of persons, especially absentees, interested in coffee cultivation.

"The Chamber can vouch for the fact that coffee plantations which have suffered repeated virulent attacks of *Hemileia* have recovered completely and have since produced large crops of unimpaired quality. The Chamber has not been able to verify a single instance of coffee trees having been killed by the agency of this pest. It is fully admitted that serious injury has been inflicted on Ceylon coffee plantations by the attacks of *Hemileia*, but the rise in the market-value of the produce has almost counterbalanced the deficiency of the yield, and the Chamber feels assured by the experience of the last seven years that the coffee enterprise in Ceylon still rests on a sound basis, and is in no danger of being "brought to an end" by the agency of the *Hemileia*."

IN COORG.

THE Administration Report of Coorg, 1876-77, tells us that the extent of coffee land held by European and native planters in Coorg amounted to 81,331¾ acres, as against 81,036¼ in 1875-76.

These statistics certainly go to show that there is no indication as yet of coffee-planting being abandoned in Coorg, and yet the record of each successive season has been—"hopes disappointed." The meagre official report for 1876-77 states.—"The coffee crops generally were much smaller than they were expected to be. It is reported that over 50 per cent. of the berries dropped off during the monsoon, owing to the unseasonable and scanty rains in April and May. In some localities, a large proportion of the berries are light and malformed." If the hearts of the Coorg planters have been made sick by continued and bitter disappointments, the circumstance has not checked the enterprise. The borer and bad seasons combined seem to defy the efforts of the planters to make coffee-culture pay in Coorg, and though the struggle appears to be a hopeless one, there seems to be no disposition on the part of the planters to resign their estates. Latest reports are by no means encouraging. In no other district, perhaps, in Southern India, has the fortitude, patience, and perseverance of the planter been submitted to such crucial tests as in Coorg.

Can coffee-culture in Coorg be made eventually to "pay"? An enquiry into the past history of coffee planting in Coorg will throw some light on the subject. Before 1855 the coffee was planted in virgin forest, a large tree here and there being thinned out. Of course this was not altogether a wise system, but it was better than what soon followed. In 1855, a number of Ceylon planters were attracted to Coorg, and formed the first open plantations. The evil spread. The denudation of forest resulted in scanty rainfall, and the borer driven from the forest trees took up its abode in the coffee. It has been observed that estates situated in forest, or the vicinity of matured bamboo have enjoyed an immunity from the borer. If this be the case the Coorg planters must endeavour to retrieve the mischief done in the past, by growing shade. The process will be a tedious one; but it seems to be the only hope that is left of making Coorg a profitable planting district.

CEMIOSTOMA, CANDELILLO AND BORERS.

IN his latest report on Kew Gardens, Dr. Hooker writes under the head of coffee disease.—

1. *Cemiostoma coffeellum.*—In my report for last year, I mentioned (p. 21) the existence in Venezuela of a disease known by the name of "Candelillo," and which Mr. R. T. C. Middleton, her Majesty's Minister at Caracas, stated to be identical with the "mancha de hierro" or "iron stain." Prof. Ernst, however, considered that they were different, and that the "iron stain" was the work of *Cemiostoma coffeellum.* The specimens of "iron stain" forwarded to this country by Mr. Middleton, proved to be the work of a fungus (*Dedalea maculosa*) and not of an insect. But Prof. Ernst has since kindly sent to me undoubted examples of the ravages of the *Cemiostoma* and the presence of that destructive insect in Venezuela can no longer be doubted. It has now therefore been ascertained to be more or less distributed through the Leeward and Windward Islands (Puerto Rico, Dominica, and Martinique) and all the Atlantic coffee-growing districts of South America.

The ravages of the *Cemiostoma* over the greater part of this immense area date only within the last twenty-five years. In Dominica, Dr. Imray informed me that he was not without hopes that by care and attention the mischief caused by it might be gradually overcome, but the following extract from a more recent communication will show how extremely difficult it is to make any progress against it, and how important it will prove if the apparent immunity of the Liberian coffee from its attacks should continue to be verified.

Dr. Imray writes—"My coffee trees (of the country) suffered frightfully last season from the *Cemiostoma*: the small crop that was coming on upon many of the trees was all but destroyed. They begin to throw out leaves again but I almost despair of finding any means of destroying the insect, where the circumstances and conditions are favourable for its propagation and existence. The problem is to discover the converse of this proposition, and I think I have made one step in that direction; it is, that the coffee trees should be cultivated almost, if not altogether, in the shade of trees, with no underwood or bush, as we say here. The coffee trees should scarcely see the sun. In a locality that is continuously cool and moist, and perfectly shaded by the foliage of large trees, they thrive best, and show very little appearance of the blight. The inference is that those conditions are adverse to the existence of the insect. From such inquiries as I have made, the coffee produced in this country, and it is not inconsiderable in quantity, is furnished by trees growing as above described. I intend to continue the experiment by planting some land cleared of low brushwood, and leaving the large trees standing. From the experience of fully two years now I do not think that in this island the *Coffea Arabica* can be successfully grown in the open, but we have now the Liberian to fall back upon."

With respect to the immunity of the Liberian coffee from the attacks of the *Cemiostoma*, Dr. Imray writes:—"That the Liberian coffee is impervious to the attacks of the "white fly," I consider a settled point. My Liberian trees have been now growing for over two years, nearly three, among the country coffee trees covered with the blight, and thus continuously exposed to the attacks of the insect, but not a leaf has been touched: indeed the destruction of one leaf by the fly would of course amount to the destruction of, or at least an attack upon all, but clearly this species of coffee is safe from the attacks of the *Cemiostoma coffeellum.* Such being the case, I have abandoned all further experiments on *Arabica*, as being simply a waste of time and money."

Candelillo.—This disease, as already remarked, is distinguished by Professor Ernst from the "iron stain" produced by the *Cemiostoma.* And in point of fact the specimens which Professor Ernst has transmitted to me prove that it is fundamentally different. The young twigs and the under surfaces of the leaves are densely covered by a white felted mycelium, strings of which appear to pass from the former to the latter. Professor Ernst has accordingly proposed for it the name of *Erysiphe scandens.* The Rev. M. J. Berkeley remarks that it is similar in appearance to the "leaf rot" of Mysore, which is produced by a distinct fungu

Pellicularia Koleroga, Cooke (*see* Kew Report for 1876, p. 20). It is possible that the disease which I mentioned last year (Report. 1. c.) as having occurred in Jamaica may be identical with the *candelillo*.

In cases of this kind, where the foliage is attacked externally by the mycelium of a fungus, the application of sulphur will probably be found effective in checking it, as in the case of the rose and hop mildew.

Borers—Dr. Kirk writes to me from Zanzibar sending specimens of the larva of probably a Long unicorn beetle which bores the stems of coffee plants from above down to the roots. It does great damage and clears a garden of trees in a few months. He adds, "with reference to the Liberian coffee, which grows well, I have found one difficulty in a huge mole cricket that with its jaws cuts off the shoot as with scissors."

LIBERIAN SEED FROM KEW.

SIR JOSEPH HOOKER in his report on Kew Gardens, for 1877, considers that, except with reference to a few places, for possible demands from which a few plants will be retained, the functions of the Garden have been fulfilled and that the field of supply should be left to the firms importing seed from Africa and growing plants. To the list of places supplied have now to be added :—

Demerara, Grenada, Honduras, Jamaica, Mauritius, Seychelles, Singapore, United States (Department of Agriculture), Zanzibar.

Dr. Hooker notices the fact that the plants in Wardian cases sent to Queensland from the Gardens proved entire failures. This he attributes to exposure and want of care on the voyage, for a precisely similar case taken by a gentleman who personally attended to it, had its 175 plants in good condition on July 18th of one year, though the voyage had extended from September 18th of the previous year. Seeds despatched to Queensland in damp moss had been a perfect success, and Dr. Hooker on this fact a caution which we recommend to intending importers, premising that we take it for granted the "seeds" are in the shape of cherries."

"I may remark a necessary caution to persons who wish to procure seed of the Liberian coffee from England that it is most essential to have it packed in small parcels and in damp moss. It germinates freely after the voyages to this country from Liberia, but a second transit has been proved by repeated experience to be fatal to it unless kept in a damp state."

A letter is quoted from Mr. Gammie of the Darjeeling cinchona gardens, stating that he had distributed plants of Liberian coffee to planters in the Sikhim Terai and Bhotan Dooars (in both cases rich, flat lands at the foot of the Himalayas) and such plants had grown vigorously, their great height and enormous leaves proving strong contrast to the Arabian species, not one quarter the height. Mr. Gammie had also planted a few in the warmer valleys of the Darjeeling hills, but he feared they would not survive the winter cold of 45 degrees. The Arabian species is not so delicate, for Mr. Gammie states :—

"With us the common coffee grows and fruits splendidly up to about 3,000 feet, but it is quite neglected by tea planters. If the red spider continues to be the serious pest among the tea bushes it has been this year, the planters will probably turn their attention to the cultivation of coffee."

So that while Ceylon planters, because of the ravages of leaf disease, are turning their attention from coffee to tea, here is the suggestion from Darjeeling that tea planters, because of the ravages of a wretched minute *acarus*; called popularly "the red spider," should give up tea and revert to coffee, which was formerly cultivated on the Sikkim ranges. There is one tea estate indeed which bears the name of "Coffee barre," from the purpose to which it was first devoted. But there must be some good reason why the cultivation of coffee was abandoned. As a general rule, there can be not doubt, the proper zone for the plant is limited to 15 degrees on each side of the equator. When we visited the Sikkim cinchona plantations, Mr. Gammie shewed us about a dozen coffee plants, which we at first thought were suffering from leaf disease, so yellow did they look. But then a terrible drought had extended to nearly seven months duration on the occasion of our visit. It seems doubtful if coffee could survive repeated similar visitations. Tea is, in many respects,—certainly in its tolerance of extremes of climate,—far less delicate than coffee, and *C. Liberica* is a specially tropical species.—Dr. Thwaites of Ceylon is quoted as hoping to have moderate supplies of seed to distribute amongst *native* cultivators before long. Mr. Murton of Singapore speaks of plants sent to the British Resident at Laroot as growing well and shewing no signs of disease. Col. Benson's opinion, addressed to the Agri-Horticultural Society of Madras, was formerly quoted in our paper. Col. Benson had seen only young plants and those on estates adjoining the Nilgiris when he formed opinions, which he will have to revise, to this effect :—

"Its general appearance and characteristics are certainly not indicative of its being a heavy fruit-bearer but the contrary, of a strong tendency to run to leaf and foliage. Perhaps its large size and corresponding increased bearing space, and its larger berries, may more than compensate for a less prolific crop; or perhaps its appearance cannot be taken as a true criterion of its fruit yielding powers."

Dr. Imray of Dominica, the island in which "white fly" *Cemiostoma Coffeellum*) had proved so fatal to the Arabian coffee, was much nearer the mark when he stated :—

"The fruit on the Liberian coffee comes to maturity very slowly, but I do not imagine more so than its own habitat, for the conditions as to temperature, moisture, and elevation are almost the same, the height it is true being something greater, between two and three hundred feet above the level of the sea, but that makes only an average difference of 2 degrees Fahrenheit. The berries of *Arabica* when they begin to redden soon ripen and become soft, and quickly drop from the tree, but I find that the fruit of *Liberica* reddens very slowly, and the berries remain hard and are firmly fixed to the branches by short stout peduncles. It is now six weeks or two months since this reddening began to appear on the fruit of my trees, but the berries are still hard. I have gathered some of them, and on removing the pericarp, which is thick, hard and leathery in structure (at present), I find the seed full and apparently perfect. Meanwhile the trees are loaded with blossom, some of the flowers have already opened and dropped, and the small fruit of next year's crop begins to appear."—*Ceylon Observer.*

A CURE FOR BUG.

A CORRESPONDENT of the *Ceylon Observer* says he has found the following treatment very successful in the cure of the white bug in *nurseries* and in *old* and *young coffee* —

Take three measures of salt, and dissolve in a bucket of water or at the rate of 3 *mus.* to the bucket-full of water; then, when removing the plants to be planted out, dip the roots of the plants in the mixture so prepared and be careful the roots only are immersed, as the salt water is injurious to the more tender parts of the plant. The hands ought to be kept dry, and the plants put in shallow baskets with the roots inward, every care taken in fact not to allow the *salt water to touch* the *leaves*, as it will burn them and they will turn black, and give the clearing a bad appearance for a short time *only*.

The cure for white bug in *old* or *young coffee* is this :—The same mixture of salt and water in proportion, as to that used for nursery plants. In the dry weather or season, remove the soil from the roots, or until you can see the roots, then to each tree put one measure of the brine, a watering-pot is the best vessel to use, as it puts the brine in equal proportion round the roots of the tree. The best implement for removing the soil is a three-pronged fork, with a handle fixed like a *mamoty*. Although the brine be made stronger, and applied in a larger quantity, it will do no harm; the leaves of the tree or a portion of them may turn black, but after a while you are bound to see the good results. The soil to be scraped towards the stem of the tree and the roots to be covered up directly after the application of the brine, with the top surrounding soil and trod well down. This application we are told will kill *grub* as well as the *white bug*.

COFFEE DISTRICTS IN MYSORE.

IN a recent issue, alluding to coffee-culture in Mysore, we remarked that the European planters in that province had appealed to Government to mark the estates off into "Coffee Districts," under Coffee Assistant Commissioners. According to existing arrangements the Revenue Assistant Commissioner has his time and attention distracted by multifarious duties, and, therefore, cannot devote sufficient time to attend to the applications, complaints, and grievances of the planters. The result is that the latter are submitted to the greatest delay, inconvenience and expense, and the progress of the coffee-enterprise is sadly retarded. A dispute between a European planter and a native farmer about a piece of ground has been known to pend decision in the Court of one of the Assistant Commissioners for so long a period as eight years. We are now glad to hear that the Government appear to have yielded to the prayer of the planters (and, perhaps, to our own representations on the subject) so far as to order the conversion of Kadur into a "Coffee district." It is also rumoured that a Coffee Commissioner will be appointed to the District. This is a step in the right direction, and we sincerely trust it will be followed up by further concessions. Kadur is rising into prominence as a coffee-growing district. Nigh on a hundred planters have opened estates on it, and the coffee forest between Baleyunore and Koppa has been pierced by good roads. The new coffee-district will comprise Kadur, a portion of the Bailur, and the whole of the Munzerabad taluqs. The Coffee Commissioner's duties, we understand will be confined to settling disputes relative to lands held by planters, and attending to the wants, grievances, &c., of that class of the tax-payers.

The extent of land in the Mysore Province that could be utilised for coffee-planting is far greater than is supposed, and the unutilised portion far exceeds that which has been hitherto turned to account. The question is naturally raised, Why should this be? The climate, soil, and elevation of Mysore are admirably adapted for coffee planting, and labour is more cheap and abundant in that province than elsewhere in South India or Ceylon. Why then should not coffee-culture in Mysore extend? It is the old, old story, the story we have gone over often before, but to which we are tempted to revert in the present issue of the *Chronicle*, in the hope that the Government, having gone so far as to form a coffee-district in Mysore, may be persuaded to go further and complete the task of settling, once for all, the planters' grievances. The tenure under which the planters hold their lands must be definitely settled before fresh enterprise can be attracted to the coffee-districts. No man with his senses about him will purchase land and start an estate, guaranteeing to abide by any laws or regulations which might hereafter be put in force regarding coffee-cultivation. Very insecure, indeed, would such a tenure be. Considering, as we have said, what a fine country Mysore is for coffee-planting, is it not incomprehensible that the Government should hesitate in employing its resources in that direction, and thus enrich the coffers of the State. Coffee-land in Ceylon sells at ten rupees to two hundred rupees per acre, while in Mysore, it goes for a mere song. Were the question of the land-tenure in Mysore definitely settled, and the rights of the planters protected against any arbitrary inteference on the part of the future native Government of the State, we have not the slightest doubt that there would be a rush for "coffee lands" in the Province. At a time when the State is labouring under a heavy debt incurred during the Famine, it is passing strange that the Government hesitate to adopt a measure which will not only recoup the exhausted revenues of the State, but definitely settle the position and rights of a most enterprising and deserving class of the population, *viz.*, the European planters.

Mysore, we affirm, is destined to become a coffee growing district, if its resources are properly opened up. The Railway from Bangalore to Mysore is a step in this direction; and one which will help greatly to develop the coffee-districts. But this is not enough. Branch lines into the various coffee-districts must be constructed. A line should run from Mysore into Wynaad, which would bring Wynaad and Coorg produce through the Mysore Province, greatly to the benefit of the people of the latter. Another line should run either from Mysore to Hassan, or from Bangalore to Hassan, branching off north to Shemogah *via* Bailu and Chickmaglur. This would bring the majority of existing estates into direct communication with the Railway, and pave the way to the opening out of the yet unutilised lands along the western boundary of Mysore.—*Madras Times.*

CINCHONA.

GOVERNMENT CINCHONA ENTERPRISE IN JAVA.

THE rains continued steadily during the second quarter of this year. The difference of the weather to that of the same months of last year was very great. Then only 21 days of April, 8 of May, and 4 of June, were recorded as rainy; this year April gave 25 days of rain, May 17, and June 20. This was very favorable for the young plants, and they developed rapidly; 7,368 days' work was performed by free labour. The work consisted in the maintenance of the plantations: some of the oldest gardens were deep-drained and manured. 6,04 succirubra, 1,000 officinalis and 6,110 ledgeriana, have been planted out. The cinchona rust increased considerably, just as it did at the same time last year. The catching of the insects was continued, and on the Chiniruan estate alone which suffered most from the disease, about 145,000 of these animals were killed. As it appeared evident that the kechubung plants (Datura sp.), on which the Heliopeltis also likes to live, greatly helped the spread of the evil, their extirpation in the cinchona plantations was resolved upon.

The experiments with the mossing system were continued, and have now been extended to a number of trees of calisaya schuhkraft and officinalis. With the old ledgerianas on which the experiment was tried last year there has been a failure: one tree died, and the other two failed to renew their bark. As this mode of barking, for this species, did not offer much chance of success, an experiment has been begun, to remove only the outer layers of the bark, leaving a thin layer on the stem, so that the cambium remains covered and uninjured. The thin layer which remains on the stem consists chiefly of fibres of bark, and contains but little quinine. The trees so far have borne this operation well, and there appears to be every likelihood that the removed bark will speedily renew itself. The analyses 49·51 have reference to such stripped bark of ledgeriana trees, and, in accordance with the experiments hitherto made, so also here, the cinchonidine which is chiefly found in the part of the bark nearest the stem, appears to be almost entirely wanting. This alkaloid, which has scarcely any value, is by this method of barking left upon the tree. The results of a number of analyses, which relate to the experiments connected with the mossing system, will be communicated later on. An examination of sample bark of this year's gathering has been commenced, whilst material is being collected for the obtaining of a definite opinion regarding the yield of quinine by ledgeriana trees raised from seed. Towards the end of July the sending out of ledgeriana seed applied for may be commenced.

IN THE WYNAAD.

THE cultivation of cinchona in the Wynaad is making head rapidly. The Ooty paper says that nearly a million of plants have been taken to Wynaad this year from Neddiwuttum estates, in addition to the extensive cinchona nurseries grown on all the coffee estates. All the poorer parts of the coffee estates are being planted with cinchona, which has been found to thrive well where coffee will not grow. On many of the new estates, cinchona is being planted at regular intervals with the coffee, for the purpose of shade.

GOVERNMENT AND CINCHONA.

IN an interesting article published on the 10th ultimo the *Times of India* observed:—

"We suppose private cultivators of cinchona must be allowed to dispose of their bark in the best markets they can find, for the outlay is a private venture, and the question is simply one of trade. But the Government outlay is not a private disbursement, but one originally and expressly instituted for the benefit of the people, and as such it should be maintained. We also protest against the Government discontinuing the cultivation of cinchona, unless the doctors are prepared to abandon their faith in quinine. The matter, it is said, is so far advanced, that Government might abandon the field of cinchona cultivation to private speculation. The time for this, we say, has not arrived, has not indeed nearly approached. For, so for as we can judge, notwithstanding all the cinchona grown in India, quinine is no cheaper, and therefore not more available for the poor than it was before the Government commenced to cultivate the bark. Since the Russian war indeed, the alkaloid has become much dearer. It is true that other productions of the cinchona tree may be purchased at a cheaper figure, but their efficacy, as compared with quinine, is small: neither have they been systematically introduced to notice, and their use rendered intelligible to the people. That cinchona bark should be grown in India and sold in London, for the benefit of foreign nations, while malarious disease is killing the people of India, appears, intolerable, and we trust may be forthwith discontinued."

With reference to this a correspondent writes to us:—

"Some men of enterprise are urging the Government of India, to hand over to them the property in and full conduct of the cinchona growth of the future. A blind deference to certain shibboleths of commerce, would here, I think, be calamitous. The work has been confessedly undertaken partly as an Imperial benevolence, partly as a wise provision for the army. The area of growth is limited—the area of demand is infinite. If now, in submission to certain canons in the gospel of modern political economy, the growers throw their produce into the general markets, the keen world competition must enormously enchance the sale value of bark—and also, as a corollary—the producing cost of the alkaloid it contains. The gain of the growers (now Government) over the expense of bark production, is a resultant manifest enough—so also would be the reward of the private cultivators. But the original profit is at once swallowed up, the advantage transformed to disadvantage, if the Imperial planter has to re-purchase quinine for his people. If we can protect our men from ague—our enemy lacking that means of protection,—we find ague our friend. The enemies' ranks are thinned by death by disability from this cause, and our antagonists are fewer than bullets, and why? King Malaria hath prisoned them. But if it be reasoned that the money profit would be in British hands, I reply money profit is not *quinine*—and quinine can in no way be obtained to satisfy even a small fraction of the vast demand for it. If it be said, oh, but the original profit on growth covers ultimate enhancement of competitive rates, I disbelieve that, and I also add that India has to pay. She casts her rough diamond from her, and re-buys the polished jewel in place of it at a disastrous cost. So I advise retention of culture; steady extension of growth, the extraction of the alkaloid in India. The establishment of a sulphuric acid factory requires capital and technical knowledge only. Both are at our command; this is not a monopoly Let private growers grow if they like, they have the world for their market, but we have a perfect right, nay it is our duty, to give to India the first fruit of the success of cinchona cultivation in this country."

With reference to this letter, and to our contemporary's article, we are glad to be in a position to state that the Government have not the least intention of selling their cinchona plantations. There would be no difficulty in persuading capitalists to give the Government a large sum for the property, but the estates were opened, and are kept up, not with a view to monetary speculation, but in order to save human life. The Government grow cinchona wholesaile at great cost hoping eventually to sell quinine retail at a price that will bring it within reach of the poorer classes who want it most. No one thinks of asking the Government to sell their 12-ton guns to a company of capitalists. Those guns are designed to give an enemy a hot reception. Similarly, the cinchona estates are nothing more than a large arsenal wherein a potent weapon is fabricated wholesale for assailing India's worst enemy—fever.—*Madras Times*.

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NOTICE.

The Indian Agriculturist *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb. 1876.

R. KNIGHT.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The Bigah in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.

ANSWERS TO CORRESPONDENTS.

In answer to enquiries from several of our readers regarding the absence from our last two issues of the monthly Reports of the Government Experimental Farms, we have to state that for the last three months no reports have been forwarded to us by Government, nor have they been published in the *Gazette of India.*—Ed., *I. A.*

Enquirer.—Nitrification utilized.—By a printers' mistake our answer to your chief enquiry was omitted in our last issue. The carbonate of lime is essential for nitrification, it predisposing by its presence the conversion of nitrogenous compounds into nitric acid, with which it combines and forms nitrate of lime. Our correspondent is no doubt mixing up the action of hydrate of lime with that of the carbonate.—Ed., *I. A.*

LETTERS TO THE EDITOR.

MESSRS COLLINS AND CO'S PLOUGHS.

Sir,—Since writing we have received yours of the 6th enclosing copy of letter from Mr. J. B. Pennington. We will send a plough for Mr. Pennington, with those for Mr. Wyer. We also have requests *direct* from other gentlemen in different parts of India, showing a wide circulation of your valuable journal, but really in writing to you our offer to send a trial plough to Mr. Harman, we had not expected so many calls for free samples. We do not object in the least to affording these gentlemen opportunity of testing our ploughs, but we dislike or regret the impression that seems to be abroad in India, that we have issued a challenge. We stated before that we are opposed to competitive trials, and it is because we have had considerable experience in such contests, and we have never known good result to the consumer from such affairs. As we have always been "winners" our "grapes are not sour." We trust the samples we are about to send, may meet an apparent want in India.

New York, Sept. 14, 1878. COLLINS AND CO.

GOLD IN WYNAAD.

Sir,—Having read in your number of the 1st October, Mr. King's report on the progress of the gold industry in the Wynaad, perhaps you will insert the following observations made by myself when erecting the works of the Prospecting Company at Devallah.

The works, as described by Mr. King, consist of a kiln in which the stone is first roasted, the quartz being run from the reef in baskets along a wire rope ; the stone when roasted is raked from the kiln and shovelled into a trough through which a stream of water flows, and the trough has a catch pit to retain fine stuff ; the stone is washed in this trough and freed from the charcoal of the kiln, and from this it is fed into a hopper with a trap and trough to the stamper. The hopper when full is emptied by the trap and the quantity of stone is thus measured.

The machinery consists of a Schiele's high pressure 10 H. P. turbine, driving a line shaft which works a single Husband's pneumatic stamper ; the slime from this passes over amalgamated tables into a Jordan's amalgamator, which consists of a hollow upright shaft and a circular iron conoidal pan at bottom, in which another pan revolves of similar shape, but with a space of about 2 inches between them ; mercury is poured into this space and the slime enters at the bottom of the pan from the top of the hollow shaft, and is agitated by the revolving pan, and has to ascend through the mercury to escape over the lip of the outer trough, so that the slime must pass through the mercury and every particle be brought in contact with it before leaving the pan, but there is no grinding, and the machine is not constructed for grinding purposes, but is simply an amalgamator.

From this the stuff passes over the troughs and tables described, and through a McDougall's trough, which is made of stout planks lined with amalgamated copper, with numerous square iron pegs or studs fixed on the bottom of it, each stud being fitted with an amalgamated copper cap, so that the slime and water in flowing through must circulate through the studs and the caps can be removed, re-amalgamated and the gold taken off when necessary. As I have not seen the works since I erected them, I do not know if this was put up, but I made the drawings for it and it was in course of construction when I left.

The over-roasting of the stone described by Mr. King, must have been simply bad management, as the heat and exposure could be regulated, and the running of the slag in the stone might easily account for the poor outturn of gold, as it would have the effect of coating the gold with iron and other metals instead of setting it free.

Of the fact that gold exists, and in paying quantities in the reefs belonging to this Company (some 8 in number) I am well aware, as I devoted many spare hours in picking out pieces of auriferous quartz from different parts of the reefs and watching the Coorumbers grind and work them, but as yet nothing has been done to cut any of the reefs underground. A large sum of money has been spent in abortive attempts to do so, but they have all failed from want of funds or perseverance, or bad engineering.

Take the Monarch or King's reef (an enormous reef which is known to extend some 20 inches in length) a shaft was sunk, some 30 feet deep, from which a heading was commenced to cut it, but as soon as rain came on, the shaft caved in, having been simply lined with thin planking, without a single setting in the whole depth. The Hamlin reef was actually passed at the entrance of the heading, which was driven into the hill some 60 feet to cut it, the reef at the entrance having been worked out and stulted up by the natives. At the Etucull Reef an attempt was made to deepen an old shaft to get at the reef, but as soon as the water at the bottom was more than one bucket could empty, it was abandoned; a syphon or pump could have been used or a heading driven into it from the hill side. The whole of the stone crushed by this Company was from continuations of old surface native workings. That opening out the reefs at new and lower points is more likely to lead to good results may be instanced by the Prince of Wales' Company.

I make these remarks simply too show how little was been done to develop the treasures of these quartz reefs, and now that we hear of the failure of the firm that promised to carry on prospecting operations in a thoroughly practical and scientific manner, I fear the whole matter will subside and be forgotten, until perhaps another half century has elapsed and the *amor nummi* revives.

Vytherry, Wynaad, F. P. HUGHES.
10th October 1878.

BAMBOO AS "PAPER STOCK."

SIR,—I do not know the present course of commercial affairs in India, but I suspect they are much the same as in England, characterised by stagnation and a total lack of enterprise, not by any means stormy, but on the contrary as dull as they well can be, waiting in fact for the "good time coming."

In bad fishing weather, however, the adage goes that "Fishermen if wise mend their nets," that is prepare themselves for better weather. Such is my object, especially believing as I do that the ventilation of the subject heading this letter, to which it is my desire to attract the attention of your readers, must, and will, at no very distant date materially affect the future industries of our great Indian Empire, not merely to assist commercial relations but benefitting the agriculturist and native laborer.

I see you have in your August number, page 267, taken note of a pamphlet written by Mr. G. W. Strettell, "On the utilisation of certain Indian Fibres for the manufacture of paper." Although, as my previous letters indicate, I have a decided preference for bamboo, believing no other raw fibre, or fibrous plant, can compete with it both as regards quality suitable for the purpose and cost of its production, I again quote the fisherman's axiom, "All's fish that comes to the net." I mean that speaking as a paper-maker using over 150 tons of fibre weekly, I shall gladly welcome *any* new fibre likely to suit our requirements which will enable us paper-makers not merely to manufacture cheap, and good paper, but to hold our own against the keen foreign competition to which we are now subjected; and further still, speaking as an English paper-maker I decidedly prefer drawing our supplies of paper-making materials from our own possessions, to being as we now are almost entirely dependent on foreign countries, with whom be it noted we have no reciprocity of interests.

I send herewith our Paper-makers *Monthly Journal* with a letter from me therein commenting on Mr. Strettell's pamphlet, which you may see well to publish with this letter,* as hardly too much attention can be attracted to the subject generally of raw fibres for paper making, which India produces in such abundance, opening a wide field to agricultural industry.

Although I cannot agree with Mr. Strettell's conclusions, I say "let the best man win." *I am not only prepared to take the 15 tons he offers but 1,500,* and the paper trade as a body would readily absorb not merely 1,500 but up to 150,000 tons, always assuming such fibre or fibres would compete with esparto in the two essential points of quality and cost. Of this there can be but little doubt, seeing that we now only carry on our trade by importing over 200,000 tons of esparto derived from Spain and Africa; countries with whom our commercial relations are as I have before remarked not reciprocal (that is to say, we have to pay hard coin for all we purchase), and these relations may be disturbed at any day.

THOS. ROUTLEDGE.

Claxheugh, Sunderland, 4th September 1878.

DIPTERO CARPUS GURJUN *VERSUS* COPAIFERA OFFICINALIS.

SIR,—On reading a late article extracted from the *Indian Forester* on the difficulties attending the growth and introduction of the *copaiba* tree into India, I referred to O'Shaughnessy's "Bengal Dispensatory," pages 222, 223, 224, (published in 1842 and now a very rare book). The learned author's position as head of the Calcutta Medical College enabled him to carry out clinical experiments in the administration of indigenous products, and to discover valuable substitutes in the Indian Pharmacopœia. On reference to the above named article it will be seen that, as the result of his large medical practice, *Gurjun* oil is pronounced equal to the more expensive and scarce *copaiba* balsam, in its curative properties, and in latter years it has obtained some repute as a remedy for leprosy.

All the virgin forests of Burmah, Assam, Chittagong, Tipperah &c. contain this valuable diptero carpus, and it is to be hoped the Forest Department have taken measures for their strict conservation. *Gurjun* oil being used largely in the native arts as a varnish and water-proof compound is also a circumstance which has led to general and wide destruction of the old trees.

Benares. W. H. LOWTHER, *Colonel.*

HONEY IN INDIA.

SIR,—With reference to CULTIVATOR'S query at page 330.—Honey is cultivated nearly all over the Himalayas. In Chamba, near Dalhousie, wild honey is found in great abundance and is very cheap. The villagers ordinarily sell it at the rate of five seers (10lbs.) per rupee, strained or unstrained; the reason being that in the former case they retain and sell the wax and so make up the apparent loss. The collection of honey would be costly as a regular matter of business, as the quantity obtainable from each village is only a few seers, and the agency for collection would be expensive; though tea-planters could turn a penny by buying up all the honey produced within the limits of a certain radius from plantations, and delivered by the villagers at their factories to avoid loss in collection. Doubtless the above price would rise as honey came to be in greater demand than at present.

Before making large purchases it would be as well to examine the flora of a neighbourhood, as honey obtained from certain plants, chiefly of the sub-tribe *Rhodoraceæ*, such as the *Andromeda, Azalea, Kalmia, Ledum, Rhododendron,* &c., is frequently poisonous. In Xenophon's account of the retreat of the 10,000, he mentions a plant—believed to be *Azalea pontica*—which yielded poisonous honey, while that from the genus *Erica* (in England known as "heather-honey"), and most *labiate* plants is wholesome.

In different countries, honey is of different colours and degrees of consistency. Red at Cayenne and Surinam; greenish in Madagascar; white and yellow in India.

Owing to indiosynacracy in some individuals, honey causes great uneasiness, or even severe suffering, but it is most likely that such cases originate in the kind of plant from which the honey is collected, or in the measures used to destroy the bees. G. P. P.

DE OMNIBUS.

HONEY IN INDIA.—Domestic bees are a very old institution in the the whole of the N.-W. Himalayas, yet strange to say, I have never met a European bee-keeper. All over Kumaon, Gurhwal, and the hill districts of the Punjab bees are housed, and treated as a profitable industry by the natives. An earthen pot (the water *ghurrah*) is let into the wall, the neck outwards—this is plugged up with clay, a small entrance hole being left for the insects. They must be highly productive, for when I was in the country about Kote Kangra in 1846, 7 or 8 seers of virgin honey could be bought for a rupee! Now-a-days at all our hill stations it is dear and bad too, being largely adulterated with flour, sugar refuse and such like; at Mussoorie I found none eatable last year. In the woods and forests of India, the wild bee is so plentiful, and its produce of wax and honey so abundant, that it is good and cheap in their vicinity and until it has reached the traders.

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* See below.—ED., *I. A.*

I think in the plains a "bee building" would have to be made surrounded by a dense plantation of shade-giving trees, near water. Such is the bee's wild habitat. *Dry heat* kills the honey-bee [illegible] without much irrigation there would be no flowers for his operations [illegible] in moist places. The *Basils* or *ocymum* species are among the hardy plants beloved by bees, [illegible] drought and have a thyme-like odour.

WINDMILL PUMPS.—These, I believe, were first used in Holland for the purpose of regulating the dykes in the low country. I saw one in active work on the marshes between Sandwich and Ramsgate more than 40 years ago. Since then I have seen some on a larger scale among the English and Dutch Colonists of South Africa, which seemed very efficient in irrigating a considerable area of ground, chiefly garden crops. There is nothing in their construction beyond the skill of a native mechanic—and I am surprised that working models have not long ago been exhibited on the canals and deep tanks of Northern India. The steady hot winds of April, May and June, besides the frequent breezes of the cold season, should yield a motive power of much value to the small cultivators and market gardeners; let a premium be offered for a *simple* air machine and it would be produced.

COCO DE MER.—When I was at Mauritius in 1860, there was a small specimen of this unique and lovely palm in the Botanical Gardens; it looked healthy, and I was informed by Mr. Duncan the curator, that this was the sole known specimen in cultivation; experiments had failed in that Island, and in all parts of the world to introduce the beautiful stranger, solitary in its habitat among the Seychelles. There has been a wholesale exportation of the nuts by curiosity dealers—from the day of their discovery. I saw a quantity at Cawnpore on commission sale in 1841, and they have been "hawked" all over the world with shells and corals by sailors, and sea-going men. When I visited that "Marine Paradise"—the Seychelles group, in 1871, boat loads of the green and ripe nuts, and grand foliage of the *Ladoacea* were being carried about the Habour of *Mahe* for sale to the newly arrived ships. The continual waste and destruction has done its worst in denudation of the "Palm" islet; a few more years and this gem of the *Palmaceæ* will be catalogued with the Dodo! I think you will find a delightful article in a recent number of *Good Words*, describing a visit to the Palm Grove; when I was there it was not under any protection, but perhaps, it may be so now-a-days. No chance of its ever growing inland in any clime, I think; the Andamans, Maldives, Coco islands, and scattered reefs, and atolls of the Ocean may possibly somewhere supply a congenial home, and I recommend *seedlings* and not *nuts* for these experiments. Let the *native soil*—rainfall and *temperature* too, be previously consulted.

PLANTAIN CULTURE.—I have lived much among the plantains in their native wild regions of continuous rainfall, rotten vegetation and steam atmosphere, the play ground of elephants and rhinoceroses, delighting in their succulent shoots and thirst-quenching stems. In lower Bengal there is little difficulty in growing superb specimens, no hot winds and no frosts to wither their existence, but the higher we ascend the Valley of the Ganges, the less our success, for the above reasons. Still I could sometimes show a good bunch even in the Punjab. First secure a sheltered position to the North-West and high boundary walls fringed with a tall row of drought-loving trees, as *Parkinsonia acacias* or *Melias*; secondly close proximity to a good well (a Persian wheel preferable). Excavate a deep trench in the poor arid soil of the North-West and Punjab (it is generally so), next if you can find a lake or jheel of that decomposed vegetation kind beloved by snipe, collect several cart loads on the margin of this bog mould and let the water run off from it. Cut your trench 3 feet deep by 4 feet broad and fill it up within 2 feet of the ground level with the jheel soil; bank up either side with the earth you took out of the trench, plant your stock of plantains about 6 feet apart in the row, daily empty all the dung and urine of the bullocks equally into the trench and, as the trees grow up continue this treatment till the hollow is filled up to within a foot of the ground level; in the hot months *flood* the plantation from your well till brimfull. Where no jheel mould was obtainable, I carefully saved all the vegetable refuse of my garden and filled the furrow with it gradually, and gave the daily supply of dung and "flush" from the well bullocks. All over the Punjab, the jheel mould is used in planting mango trees; an enormous pit is dug and filled with it, on this the young mango tree is planted, otherwise they would get no nutrition or moisture on sandy plains far from a river. When the plantain trees have attained mature size, their cool damp shade is most useful in protecting tender exotics from the sun and simoom wind, and in the furrow I used to raise all my celery. There are many [illegible] manures which in a liquid state might prove valuable in enriching the [illegible]. The pools where *jute* and *sun* have been steeped, the refuse of the distillery and sugar refinery, perhaps the *seet* or indigo refuse—any one of these experiments could be tried on a single clump. *Leaf mould* is the *natural* food of the plantains in a fresh and newly fermented state, and where there is no jheel supply, make it by trenches and irrigation.

ASPARAGUS.—When I met with the French discovery of treating the beds with tan, I bethought me of our Indian substitute the cocoanut fibre refuse, which I have been using in horticulture for two years past, with good results in the flower-pot and propagating box, and [illegible] to try it in the growing season as a *stimulant* on my asparagus. *Elephant's dung* [illegible] nearly equal to tan; my artichokes treated with it were monsters; two were [illegible] heads, that I used the carving knife and gave one-third piece to each person [illegible] a breakfast-plate was invisible with a green head placed on it!

THE SNAKE PLANT.—I take this to be a cousin of our old English *Arum Lords* and *Ladies*; very unpleasant to the nose though pretty to the eye, it covers all damp shady slopes in the Himalayas. The *Aconites* are Alpine plants, with charming blue flowers, not unlike a *monk's cowl* (hence the name). At Mussoorie last year, the above little *Arian* might be seen scattered over miles of ground; but there was not one case of cholera. *Arum maculatum* is, I am almost sure, its botanical designation, it seems very nearly allied to the European plant.

VITALITY IN TRUNKS OF TREES.—When I was in South Africa, I met the persons who packed and sent to Leyden the entire trunk of a *Zamia horrida*, that primeval type of hoary vegetation. It was acknowledged by travellers and botanists of experience to be the oldest and largest specimen ever discovered. I have seen several of these relics in my wanderings, but they are few and far between and exist only near the seaboard, and Algoa Bay district—weird scaly plam-like grey trunks with a cycas-like tuft of hard leaves atop looking *deathless* and out of date! Brehm the Dutch botanist built a case expressly for this monster. No tree of modern times, and of that age could have resisted such treatment. Brehm died soon afterwards, and I am sorry to add his successors love money better than botany. I saw the defunct enthusiast's bulky herbarium being scattered to the winds for the sake of its paper wrappers. He was great at South African *Materia Medica* and I fear his discoveries have died with him. He was a chemist and apothecary in the village of Uitenhage of great repute at the University of Leyden.

WALNUT WOOD.—In Cashmere about 25 years ago, a great storm felled to the earth one of the finest walnut trees in the valley, and I was permitted to supply myself with what I required. I carried away 2 coolie loads for gun stocks of prime, dark-hued timber, which spoiled the tools of the workmen employed in sawing, and subdividing the wood; there were many such aged trees then in the retired corners of that fertile vale all liable to be levelled to the ground by a tempest.

THE CAROB BEAN TREE.—In the dry, hot localities of Egypt, and Cyprus, this useful fodder tree possesses the great property of stubborn vitality. Droughts may come in close succession, and armies may raze the visible existence of growth, yet it will bide its time, *under ground*. Lindley in his "Vegetable Kingdom" gives us one instance of its indestructibility, when Napoleon's army cut an old one to the root, and it disappeared for many long years till irrigation brought it to light. Why should not this hardy gift of nature be utilized all over the Punjab and droughty districts of the N.-W. Provinces, alongside the canals, and in Southern India why should it not succeed? I saw a solitary specimen growing in the garden of the old Dutch Naturalist above mentioned; it was about 20 feet high, but I never met with another specimen in all my South African rambles; to the farmers there it would prove a treasure as a winter fodder.

Benares. W. H. L.

ALOE FIBRE.

SIR,—I enclose you an article on Aloe Fibre rope, which I have cut out of a home paper just received. In your number of November 1876, you also mention a machine in use in the Mauritius for producing fibre direct from the aloe leaves without any retting process being necessary. I would therefore be much obliged if you can kindly give me any information about the machine employed in the Mauritius, as if not very expensive, I would feel much inclined to purchase one of them, as aloes grow here in great quantities and with of course very little care.

Hosoottay Estate, Munzerabad,
September 16th, 1878.

FERGUS W. SMITH

IRON wire has largely taken the place of hempen ropes in the rigging of ships and for other purposes where durability, rather than pliability is required, but wire rigging, though it has an advantage in the matter of durability, cannot be used for running gear and it has the disadvantage of being peculiarly liable to rust, especially from sea water. The best Manilla ropes are subject to a kind of "rot" under the influence of salt water, and a material which should combine the toughness of iron—without its liability to rust—with the suppleness of hemp has long been desired. Even the celebrated New Zealand flax (*phormium tenax*), though it answers admirably for ordinary purposes, is not capable of sustaining for more than a limited period the joint action of wear and tear and salt water. A fibre answering to these requirements has been found, it is alleged, in the fibrous leaves of a species of aloe growing in Mauritius. Its leaves, after being simply crushed, and without requiring the elaborate maceration necessary with flax or hemp, furnish long and tough threads, which are said to excel in tenacity iron wire of similar thickness, while the suppleness of ropes made of this material is equal to that of Italian hemp. But the speciality of the material is its durability, and the absence of the excessive contraction and expansion when wet or dry, which are so inconvenient in ordinary ropes. It is also perfectly unalterable in salt water. Small quantities of the fibre have been from time to time collected and sent to England, where it has been favourably reported on; and a regular trade is springing up. If all that is claimed for the new rope is true, it ought to prove an invaluable acquisition for collieries, where men's lives hang on a single rope or by a treacherous iron chain, when being hauled up or down in the cage, and for other purposes as well as for shipping. Unfortunately it is derived from a plant which is of very slow growth; but as the species of aloe will grow readily in the most arid soil and in temperate climates, its cultivation might be extended to other countries besides the limited island to which it is at present confined.

IRRIGATING COFFEE.

SIR,—Will any of your planting correspondents kindly oblige me with information as to the practicability of irrigating coffee during the hot season?

My estate, with the best of soils, grows splendid coffee, but the elevation is rather low (2,600) and the blossoming months are very hot and dry. Last year I had blossom withering from want of rain to the tune of fully ten cwts. per acre. Could I remedy such mishaps by utilising a spring which has its rise on the slope above the estate? The expense of bringing the water to the estate and leading it all over the cultivated part would be paid off in a single season, if thereby I only saved one cwt. per acre. Surely, irrigation must have been tried in Ceylon; what was the result, and how should it be done?

Malabar, September 1878. COFFEE PLANTER.

PRICKLY COMFREY.

WE have received the following from Dr. John Shortt:—"As I observe that no reply has been given to a correspondent of yours who wrote some time last month anent the cultivation of prickly comfrey as cattle fodder, I venture to relate my experience in the matter, small as it may be. I obtained a single plant from Mr. Cameron of the Lal Bagh, Bangalore, in November last, which I planted in a pot under shade, where it grew most luxuriantly, and threw out three suckers, some three or four months after; those I removed and planted on open land with a fair amount of shade, where they, as well as a parent plant in the flower pot, struggled through the subsequent hot months, and were found just alive when the rains commenced last June. I took up the original plant, and finding it had a long sap root extending some seven or eight inches in length, I cut it up into several pieces, planting them in a pot. Of these, five readily sprouted and promised to grow vigorous, whilst the others rotted off. As we have had very fair planting weather, I removed the original plant and the cuttings from the pot, and planted them with the three original suckers, and I have now some nine plants all looking fresh, and promising to grow strong. From this small experiment I have come to the conclusion that the prickly comfrey, like other newly introduced articles, has been vaunted as something wonderful, whereas I find that other fodder-producing grasses, such as hurriallee, Guinea grass, sorghum, lucerne, and even horse-gram, &c., grow much more rapidly, or at least equally so, as the prickly comfrey, and when irrigated and manured will produce from six to nine crops in the year. I have actually seen such crops realized, and they are universally relished by cattle, whereas my ponies, English and country cows, refuse the prickly comfrey. Of course in my experiments with the prickly comfrey, I neither irrigated nor manured the plants, but simply planted them under light shade in a rich soil abounding in humus, leaving them to nature; but in a climate like this (Shevaroy Hills), I think they should have done better, if all that was said of the prickly comfrey be correct."

THE SAME.

To the Editor of the Madras Mail.

SIR,—Dr. Shortt's communication, which appeared in your issue of the 19th instant, regarding this plant, has induced me to send you a short account of my experiences with the prickly comfrey. Like many others I was led to believe in this wonderful fodder from the glowing accounts I read of it; so I imported four cases of roots from England about a year ago, and planted out three cases (about 1,200 sets of roots in my farm, in land which is undoubtedly good, and fit to grow anything. In planting I paid strict attention to the instructions sent me; went to much expense in pitting for each set, and manured well, and though the roots sprouted quickly, and a lot of leaves where thrown out, yet could not get anything like a decent crop of fodder. I tried irrigation (this was still more expensive) and I got a supply of green food; but after I ceased to water, the lot gradually decayed, and the roots rotted in the ground. I transplanted some, but it was fruitless; and I now am convinced that the account of the wonderful producing properties of the prickly comfrey is a gross exaggeration as far as my experience goes. I have given it a very fair trial on good land, and failed. Perhaps somebody will try it on the top of a rock, and let us know how he succeeds. As a further trial, I put some roots (kindly sent me from the Wynaad) in pots placed under my verandah. These I watered daily; they grew well; but their growth was not such as to lead me to conclude that heavy crops of fodder (like what is got from hurriali grass) would result even were the cultivation of the comfrey a success.

I also gave some roots to friends, who went to some trouble and expense to cultivate them, but their experiments resulted in failure too. I saw the land in which they were planted, and it was good rich loam. Horses ate the comfrey after a little coaxing, but did not shew any eagerness for it; my cows and cattle sniff at it in a disdainful sort of manner, while sheep will not look at it.

On the other hand, I planted, at the same time as I did the comfrey a similar plot of land (about three-quarters of an acre) with "Guinea-grass," which I obtained from the Experimental Farm here, and this has so far been succesful that I have had four cuttings from it. The grass gave me no trouble after I had once planted it, and I have only irrigated the lot about eight or ten times in twelve months. In addition to this I am in a position now to plant out another acre of land with roots obtainable from those I put down; my cattle like the grass even though it is dry. I may venture to say that the opinion of Mr. Harman Superintendent of the Experimental Farm, and Mr. Cameron, of the Lalbagh, was not at all in favor of the "wonderful," comfrey; this I gathered from conversations I had with both on the subject prior to my getting a supply from England, and after they had each planted some roots personally.

Bangalore, 20th Sept. THOS. T. LEONARD.

A NEW SOURCE OF REVENUE FOR INDIA.

To the Editor of the Paper Maker's Monthly Journal.

SIR,—Discussion on any subject, however interesting, can hardly take place without rejoinder, and as I learn that Mr. Strettoll has left England for India, for the present at least, he cannot reply to my remarks on his pamphlet in last months' Journal.

Writing simply from a paper-maker's point of view it is obvious that the trade would, one and all, welcome *any new* fibre introduced into the market of a quality and at a price suited to their requirements, whether that fibre be "UK" or "Bamboo."

Occupying the position it does, it will, I think, be admitted that Esparto or Alfa must be taken as a standard both for quality and cost, and that any new fibre or fibrous material introduced, or attempted to be introduced, must be at least equal to Esparto in both their essentials.

I do not, of course, reiterate these platitudes for the benefit of paper-makers, who perfectly understand what will suit them, but, for the information of those I must term outsiders, who, having got hold of a plant which will produce fibre—be it good, bad, or indifferent—at once jump to the conclusion that it is adapted for making paper, without duly considering the cost of preparing such fibre, or probably without even knowing what mechanical appliances are needed for such a preparation, possibly without having even seen such machinery in operation, and most likely ignorant of the subsequent processes needed to treat and convert it into "Paper Stock" or paper.

The cost of producing or cultivating any fibre-yielding plant, of harvesting or collecting the quantity of the raw plant produced per acre, as compared with the ultimate yield of marketable fibre per acre of cultivation, or per ton of the raw material—most important factors, together with the cost of manipulation—are subjects that but rarely enter into calculation.

Without wishing to detract from the merits of the "UK" fibre as a textile material (as its value is unquestionable for such purpose), I feel assured that neither it nor any other exogenous fibrous plants of similar character can ever compete with Esparto, nor be produced at a sufficiently low cost to permit of their being employed as paper-making materials. The fibre produced from this class of plants consists of a thin membranous tissue surrounding a reedy or woody stem; the yield of fibre from the *dried* stems not amounting to more than 10 to 15 per cent. It is obvious that in their *green* state a large mass and weight of raw material has to be harvested and carried, and to say nothing of the subsequent retting or steeping required, the cost of manipulation by hand or by machinery to separate the fibre from the internal woody stem must necessarily be very heavy, evidenced indeed by the price these fibres, such as flax, hemp, jute, and "UK" will command in the market. Again, as all so-called raw fibres must pass through a process of boiling in alkali before they can be bleached and converted into paper, to free them from combined gummo-resinous and coloring matters, during which process they incur a further loss in weight of from 30 to 40 per cent. or more, this loss, added to their original cost of production, renders them prohibitive for the use of the paper-maker, their tow or waste excepted.

The plants above referred to are termed herbaceous, produced annually from seed. There is another class of exogenous plants of a shrubby nature, growing perennially or produced from cuttings, the shoots or twigs being taken therefrom at a proper age; the fibre in these consists of a true bark in layers, and from them after drying and steeping to facilitate separation the bark is stripped by hand. Of this class are Rheea, Böhemeria Nivea, Daphne, Paper, Mulberry, &c. &c. The fibres from such plants will, naturally be even more costly than the first-mentioned.

There is yet another class of exogenous fibrous substances, such as Adansonia, Lace Bark, &c., but as these are produced from forest trees sparsely distributed over large areas of country, and taking a long time to grow even if cultivated, it is not probable that they will ever be available in large quantities, or at a price to meet paper-making requirements.

As a basis of calculation all fibrous plants must be taken as *dry*, and the yield of fibre resulting therefrom has been estimated as follows. Flax from 5 to 6 cwts., hemp 7 cwts., jute 6 to 7 cwts. (10 cwts. has been reached), and at page 24 of his pamphlet Mr. Strettell puts down "U K" at from 5½ to 6½ cwt. (these per acre), at page 16 he allows 5½ tons, 110 *cwts*., for dried Bamboo stems per acre.

Now I have previously mentioned that all the so-called raw fibres: to be converted into stock must be boiled, during which process they lose from 30 to 40 per cent. or more in weight. Bamboo loses 40 per cent., yielding 60 per cent. "Stock" (an error of the printer's in my last letter makes this only 40 per cent.); the 110 cwts. of dried stems, therefore, of Bamboo at 60 per cent. will yield 66 *cwts*. stock as compared with Mr. Strettell's 6 *cwts*. "U K" Fibre. These figures speak for themselves.

With your permission I will resume this subject in your next issue, referring to endogenous fibres in comparison with Bamboo.

THOS. ROUTLEDGE.

The Indian Agriculturist.

CALCUTTA, NOVEMBER 1, 1878.

THE USE OF LIME IN AGRICULTURE.

AMONG the various means at our disposal, of improving soils both chemically and mechanically, stands very prominently the *Liming of Lands*, which deserves next to Manuring and Draining the careful attention of the Indian agriculturist, for the use of lime in agriculture, though it has been known and practised for centuries past, in Europe is, in India, as yet quite unknown as a practice.

Lime is widely distributed, and appears as a constituent part of all fertile soils. It is in itself a valuable constituent of mineral plant-food, and as such, its presence in manures will benefit the plants to a greater or less extent, according to the larger or smaller proportion in which they require this element of plant-food; and a few examples of which are represented in the following table:—

Percentage of lime in the ash of

Tea	6·5	per cent.
Ceylon coffee (berry)	4·10	"
Cocoa (bean)	7·72	"
Potatoes (stem and leaves) ...	46·20	"
Tobacco	67·44	"

But it is not lime in its action as a constituent of mineral plant-food, but in its powerful mechanical and chemical effects as a decomposing agent of our arable soils, that we shall deal with it in this article. Lime—kunkur as it is called by the natives of India—is properly speaking more or less impure carbonate of lime, and is employed for agricultural purposes both in this, its natural form, or as "slaked lime." "Slaked lime," we may say, is kunkur, or lime stone, which has been exposed to a red heat (burnt) and thus deprived of its water and carbonic acid, and which has afterwards been slaked into a powder, by sprinkling it over with water or otherwise exposing it to the influence of moisture. In its natural state, as more or less impure carbonate of lime, (chalk, marl or powdered Lime-stone) it is chiefly added as a nourishing manure to soils naturally deficient in lime, or in case of light soils with the object of improving the texture and mechanical condition of the soil. In the latter instance the application has to be repeated, at intervals of some ten or twenty years, as the chalk or marl sinks gradually into the subsoil. The texture of heavy clay soils is likewise, though in an opposite way, improved by the addition of kunkur. Kunkur, powdered—of course it cannot be used otherwise—if applied to sandy soils will make them heavier, while if applied to clayey soils will make them lighter, the reason being that carbonate of lime stands intermediate between sand and clay, in tenacity and in its power of holding water. Thus red lands and clay soils in Lincolnshire, as stated in Mr. Clarke's "Practical Agriculture," are dressed with 40 cart-loads per acre of white or blue marl, the effect lasting for a long series of years. And in Norfolk on the contrary, it is chiefly sandy and peaty soils that are *marled*. In Kent, carbonate of lime or chalk is extensively used, chiefly on heavy soils, and more particularly on pastures. From 12 to 18 tons per acre are commonly applied, but then no repetition is needed for twenty years, and after that only a light dressing now and then is required. It is evident, of course, that chalking or *marling* clayey or sandy soils, will only pay on lands in close vicinity of the raw material. For chalking heavy lands, shell sand, containing as a rule a considerable proportion of carbonate of lime, will answer as well as chalk, and is in fact used extensively in Ireland and on the coast of Cornwall, being transported often to considerable distances into the interior. In the Normandy and other coast districts of France, shell sand is likewise in great demand and largely used. We draw particular attention to this, as shell sand is most abundant on our Indian shores and is generally of very fair composition. Some shell sand gathered near Bassein, in the Bombay Presidency, we found to contain as much as 70 per cent. of pure carbonate of lime in the shape of small fragments of broken shells, an appreciable quantity of animal matter and small quantities of soda and magnesia, 25 per cent. only being sand. We would prescribe 20 to 30 cart-loads of powdered kunkur or shell sand per acre for either light sandy or heavy clay soils.

The effect of *chalking* or marling lands, is, as our readers will understand, chiefly mechanical, the addition of carbonate of lime improving the texture of heavy clay-soils by rendering them lighter and more porous, and therefore more permeable to the influence of rain and atmospheric air; and it being of intermediate tenacity, it is also able to confer a higher degree of consistency upon light, sandy soils. The effect of *liming* lands, is on the contrary chiefly chemical. In liming lands, slaked lime is employed, and in this, its caustic state, it has a most powerful effect of decomposing the mineral matter of the soil, chiefly the silicates, and liberating their alkalies. Its causticity further increases manifold the desintegrating action of heat, moisture and atmospheric air, and assists thus in the liberation of the elements of mineral plant-food from their unassimilable combinations, and converts them into available plant-food; it sweetens sour soils, by combining with the vegetable acids and forming neutral salts, no longer injurious to vegetation, and it accelerates the decomposition of organic matter in the soil and renders them in a shorter time their component parts available to plant-life.

Liming in heavy doses, used to be a fundamental feature of farming in England, and, we may say, over the greater portion of the Continent, and is still so, *excepting in some parts of England, where it has now given way to a great extent to artificial manures.* Lime, as slaked lime or "chunam," is employed with most effect (1) upon soils that are naturally deficient in it, (2) upon stiff clays, (3) upon peaty or humus soils, containing a large amount of undecomposed vegetable matter. In England *liming* is now chiefly confined to heavy clay soils and newly broken-up lands, and where it is the custom to lime once every rotation, the quantity used is about 100 bushels or 4 tons per acre. On light and peaty soils smaller doses are repeated, so as to allow for the gradual sinking of the lime into the sub-soil. For *newly* broken-up heavy lands, 8 tons per acre may be used as a first application. Heavy tea or coffee soils, under bearing, may receive, for instance, 4 tons of slaked lime per acre well dug in; new lands that are prepared for extensions, will be able to stand as much as 8 tons per acre. For lighter soils half this quantity should be used. The use of lime on a large scale, must, however, be accompanied by liberal manuring; for slaked lime will render a large quantity of mineral plant-food available in a very short period, giving the plant the opportunity of absorbing, say in one year, what under ordinary circumstances would not have become available for, say five years, and without liberal treatment of the soil a reaction would set in after a few years, that would almost permanently incapacitate the soil to yield remunerative harvests. Experience in Europe has proved the above and hence the adage, that "lime enriches the father and impoverishes the son."

But where the use of lime is accompanied by a liberal treatment of the soil, by good cultivation, and ample manuring, there it will always be followed by the best results, permanent in their character. Some experiments made with *liming* in Saxony, by Træger of Oberbobritsch gave the following results:—

		Per acre unmanured.		Per acre manured with 5½ tons of slaked lime.	
		Corn.	Straw.	Corn.	Straw.
		lbs.	lbs.	lbs.	lbs.
1851	Rye	1,453	3,015	1,812	3,773
1852	Oats	1,528	1,812	1,748	2,320
1853	Potatoes ...	9,751	......	11,021	......
1854	Clover Hay ...	911	......	2,942	......

Lands should be *limed* about two or three months before the crops are sown, and well ploughed or cultivated immediately afterwards. Of course, some soils and descriptions of land—calcareous soils for instance—receive no benefit from liming, but excepting these, most clay-soil will benefit by *liming*, most light-soils by *chalking*.

COFFEE LEAF DISEASE AND RED SPIDER.

We have until lately been so isolated in our opinions regarding the causes which have resulted in raising such powerful enemies to our coffee and tea industries, as *Hemileia vastatrix* and *Acarus theivora*, that with some gratification we quote the following extract from a recent letter addressed to the Chairman, Chamber of Commerce, Colombo, by G. W. Horsfall, Esq., the Manager of the Ceylon Company, Limited, representing large planting interests in various districts of Ceylon. Mr. Horsfall writes: "I have my own theories about the origin of the coffee leaf-disease; and I cannot but think that it would be found to be traceable to a system of cultivation, which through successive generations from a common parent stock, and without any mixture, so to speak, of fresh blood, in and in breeding in fact, has until late years at all events, been directed to the one subject of *increase of yield*, totally irrespective of improvement of stamina, and of the varying conditions as to soil and climate under which that cultivation has taken place. I believe also that planters in one way or another are beginning to recognise this fact; and that more attention is now-a-days being paid to the scientific application of manures, than has ever been done hitherto; and that in this combination of scientific and practical farming will be found the best antidote for the evils of *hemileia vastatrix* and other coffee pests." We cannot give too great prominence to these few lines, which contain the keynote to successful planting. Mr. Horsfall's opinion, as a planter of large experience and representing vast interests, coincides so entirely with what we have endeavoured for years past to impress on our planters, that it cuts away the ground from under those who denounced us as mere theorists, and we are not without hope but that many may now be induced *to try at least*, what advantages can be derived from a rational system of cultivation.

If we take into consideration, how coffee and tea plants (perennial shrubs it must be remembered) have been treated in the past, how their fruits and leaves have been plucked year after year without restitution of the plant-food withdrawn, how the resources of the soil have been treated as inexhaustible, how the shrubs have been hacked about in every imaginable way, how they have been stripped periodically of all leaves (their most vital part), in the vain hope of getting rid of pests which were but the result of the planters' previous malpractices—the wonder is, not that the plants are diseased and offer fertile ground for the propagation of animal and vegetable parasites, but that the plants are still alive. Let planters acquire the very first rudiments of their profession; let them learn and apply the main principles of how to cultivate, manure and drain lands, and we will predict a bright future for the coffee and tea interest in this country. But as long as we have men in charge of estates who take away the lungs and stomachs of plants with the object of making them healthier, who think that there can be a perpetual harvest without manuring, and who are at a loss to account for the tap-roots of tea plants turning upwards, for the feeding roots to be confined to the surface and for such plants to be unhealthy, and who in the way of a remedy for this, go and root up the old plants and plant new ones—so long as we have men who are ignorant of the very rudiments of their profession, and as long as we have proprietors who do not press their servants to learn these matters, so long will coffee and tea estates be ravaged by *Hemileia vastatrix* and *Acarus theivora*. There can be no doubt left in the mind of any one who has studied the subject, that the blights and diseases which are ravaging our coffee and tea gardens, which are spreading yearly over larger areas, and which are now considerably reducing the yield are but the result of the planters' malpractices, both past and present. These chronic blights are but signs of the unhealthy state of the plants; they are unmistakable evidence that the soil will not yield harvests indefinitely without manuring, and that seed from weak, diseased plants cannot produce other than weak, diseased offspring, which even in the most fertile soils cannot recover the stamen their parents have lost under an irrational system of cultivation.

But the worst of it is, that healthy, well-managed and well cared-for estates have also to suffer from the neglect and ignorance of their neighbours. Leaf-disease and red spider will attack tolerably healthy plants which, but for the contiguity of an affected garden, would have escaped, but in such well-managed gardens, it is needless to say, the blight will never establish itself permanently. We hold that for the successful and fruitful propogation of such blights as coffee leaf disease and red spider, a peculiar diseased state of the sap of the plant is necessary, such a condition of the sap being most favourable to the life and development of the parasites, and which condition, in the case of the red spider, we may say, we have proved to be sourness. This diseased state of the sap may now, of course, be due to many causes, the chief of which, no doubt, are :—

1. (*a.*) The continual withdrawal from the soil, without restitution, of plant-food in such proportions as required by the plant, causing either an excess of some of the elements and a corresponding deficiency of others, or an insufficiency of *all* the elements of plant-food, which in either case will result in weakening the plants, reducing the yield and propagating blight and disease.

(*b.*) The original absence or deficiency in the soil of one or more constituents of mineral plant-food.

Remedy—Judicious manuring.

2. Unhealthiness of the soil, caused by stagnation of water, impervious clayey subsoil, superabundance of decaying organic matter and similar causes.

Remedy—Liming and draining.

3. The want of stamen, the plants having been the offspring of weak and diseased parents.

Remedy—Either extra nursing of the plants for some years, comprising chiefly careful cultivation and ample manuring, or substituting seedlings from plants that are known to have been healthy for a preceding period, of at least three years.

The blight itself may be directly attacked and its ravages temporarily stayed by dusting caustic, fresh slakened lime during a moderate wind among the bushes, or syringing them with water containing kerosine oil.

But, will some of our planting readers ask, will this high cultivation, you advocate, pay us? We answer most emphatically in the affirmative, and we add that it is *only high cultivation* that will *now* pay proprietors of tea and coffee estates; it is only gardens under high cultivation that can bear the heavy yearly expenditure and leave a fair profit to the proprietors, omitting of course such exceptional cases as the Assam Company presents. We can point out gardens that have for years been worked at a loss, suffering heavily from red spider and other blights. The plants were stunted, and the yield often not more than 2 or 2½ maunds per acre. The soil rich clayey, full of organic matter. After suffering heavy losses for many years, the proprietors at last determined to thoroughly subsoil and drain the garden. The results are that the estate is now almost free from blight, and yields at the rate of 6 and 7 maunds per acre. The previous unhealthiness of plants is in this case, no doubt, due to causes detailed under No. 2. With regard to manuring, there is now sufficient evidence on record to convince the most sceptical that with an expenditure per acre of Rs. 30 to 40 for any manure but the expensive guano, ammonia and other *forcing* manures, an additional yield of 1½ to 3 maunds of tea per acre can be obtained, which leaves a very large marginof profit and in addition the health of plants permanently improved.

AN AGRICULTURAL AND FOREST SCHOOL.

NINE years ago, in 1869, a scheme for the establishment of a Forest School in India, for the training of natives for the superior appointments in the Forest Departments, was submitted to the Government of India, and now at last a long Resolution has been published concerning a Central Forest School to be established at once in the North-West Provinces, and Captain F. Bailey, R. E., Superintendent of Forest Surveys, has been appointed the first director of the institution. Considering the length of time the scheme has been under the consideration of the Government, we cannot congratulate it as sincerely as we should wish on the birth of this project. With so many perfect models of similar institutions before them, we must confess we expected something more than an elementary school for the training of a few foresters and forest rangers. If the scheme is to benefit the country at large, and be of real usefulness to the development of the resources of the Empire, it must be something more than a mere training school to teach a few natives at the expense of the tax-payers to earn their livelihood. We say that to be more than a mere waste of public money, the proposed Central Forest School must be something more than a mere Forest School. With the great and acknowleged want of agricultural education pressing upon them more and more every year, it is surprising that Government has entirely overlooked what a great opening this Forest School offers for the initiation of agricultural education in Northern India. Forestry and agriculture are closely allied, the majority of colleges on the continent, teach both subjects, and some of them might have served as models for this Central Forest School. The Hohenheim Royal Academy of Agriculture and Forestry, is one of the most perfect of those institutions. It is situated near Stuttgard and was founded in 1818. Its renown is now so great that men of all nationalities are found among its students. The course of education at the Hohenheim Academy comprises three separate schools *viz.*, the higher agricultural and forest school, the agricultural labor school and the horticultural school. The higher agricultural and forest school, to which students of eighteen years and upwards are admitted, embraces a complete course of instruction in all the branches of agriculture and forestry, and aims to prepare men to manage their own estates and forests or to become stewards of large proprietors. Instruction is imparted principally by lectures and practical demonstration; the course extends over a period of two years. The agricultural labor school is distinct from the higher agricultural and forest school, and has for its object the training of men to fill positions as farm-bailiffs, or to manage small estates. The practical training of the students who enter this school is deemed to be the most important, and consequently, they are compelled to work as laborers on the farm, while their theoretical instruction is limited to an average of two hours daily. The course extends over a period of three years, and students are admitted from sixteen years upwards. The horticultural school is likewise an independent department, but our botanical gardens provide, or ought to provide ample education for the natives of this country.

To the Academy there are attached, (1) a farm of nearly 1,600 acres serving for educational purposes. Every improvement in agriculture is represented here, such as a rational system of rotation of crops, careful and thorough cultivation of the soil, proper treatment of manures, drainage, irrigation, &c; (2) An experimental farm of about 50 acres in plots of 1½ acre each, on these plots experiments are conducted to test the relative value of different manures, the advantages of deep over shallow tillage, the comparative effects of thin and thick seeding, of broadcast sowing and drilling, the fecundity of seeds from different localities, and a few plots are set apart for the acclimatization of new and valuable products; (3) A botanical garden for the illustration of the lectures on botany; (4) a vegetable garden; and (5) a vineyard. The forest attached to the Academy extends over nearly 20,000 acres, including a nursery of exotic trees, and offer every facility for complete practical instruction in forestry. The Academy further includes a beet-sugar factory, brewery, distillery, starch factory, vinegar factory, *fruit* drying establishment, &c., the object being to demonstrate practically lectures on agricultural technology. There are, of course, also a large library, a museum and a chemical laboratory, of corresponding magnitude, attached to the College. The cost of residence and instruction for students of the agricultural schools only, is (for foreigners), for the first year £25, for the second year £17. For students of the forest class (foreigners) £17 per annum. There are in the Academy twenty professors and assistants. The following are the courses of study at this college :—

Agricultural Course. 1. General farm management and the cultivation of ordinary farm crops. 2. The cultivation of special crops. 3. The management of meadows. 4. The cultivation of the vine, the hop and the tobacco plant. 5. The culture of fruit trees and kitchen gardening. 6. Breeding and general management of agricultural stock. 7. Sericulture. 8. The keeping of bees. 9. Instruction in the business and general management of an estate. 10. Agricultural taxation. 11. Agricultural book-keeping. 12. Agricultural technology. The lectures are demonstrated by practical classes on the farm, in the laboratory and also by field excursions.

Forestry Course. 1. Encyclopædia of forestry. 2. The connection between forestry and agriculture. 3. Forest botany. 4. Management of forests. 5. Conservation of forests. 6. Economical use of forests and forest technology. 7. Duration of forests. 8. Forest taxation. 9. Study of State forestry. 10. Laws relating to forests. 11. Disposal of the products of the forests. In connection with this course are held practical classes in the different forests attached to the Academy, in the botanical garden, among the collections of woods in the museum, and in the nursery of exotic trees.

The *accessory studies* include arithmetic and algebra; geometry and trigonometry; surveying and levelling; valuation of forests; mechanics and physics; chemistry, geology, botany, vegetable physiology and zoology; special zoology of vertebrates for forest students, &c.

Now what we want the Government of India to do, is to establish, instead of a Central Forest School, *a Central Agricultural* and *Forest School,* open to all, on the model of the Hohenheim College, and offer the natives of this country an education, that will make them useful members of society, not chattering magpies, which, with few exceptions, is all our Universities can boast of; and above all an education which should assist greatly in *developing the immense resources of this Empire.*

THE KUMAON IRON WORKS.

EVERY one interested in the welfare of India, would probably desire to see its inhabitants less dependent, than at present, upon agriculture for their support. And in this view, the establishment of manufactures, whether from mineral or vegetable products, is a thing much to be desired. So fully did Government appreciate their importance, that more than eighteen years ago, they established iron works in the North-West Provinces. In 1860, they sold these works to a private company, which had been formed about the time of the mutiny by General Henry Drummond, and which was composed largely of Government servants, who hoped to receive good dividends for their investment; and, had this been the case, they would no doubt have benefited the country, while themselves profiting. The history of the company is, however, one of repeated failures. Efforts, courageous but ineffectual, were made, with invariably the same result. Whatever management was tried, there were no profits, and these results, always of the same character, ought to show to any one not over-sanguine that the want of success has not been due to the nature of the management, but to other circumstances, the most important of which are locality and want of communication with the outside world. The experience of 1863 has, however, been disregarded, and, quite recently, further efforts have been made and more money has been spent, with a new management, and with precisely the same results as before. But this time it has been public and not private money that has been expended. We do not object to an outlay of public money in any reasonable endeavour to establish so important an industry; but we think the time has come when any further expenditure *on the works in the North-West Provinces should cease.* The fact that this enterprise is a failure should be accepted by Government and the shareholders with such resignation as may be possible, until the circumstances of the country either so far alter, as to make the successful re-establishment of the concern possible, or change so little as to prove that any further endeavours must be, as they have hitherto been, futile. The history of the company is comprised in voluminous correspondence and reports, but it may be stated briefly. It was intended at first to make only cast iron, for which a ready sale was looked for in the shape of rails, a project being then under consideration for the construction of a rail or tramway in the North-West Provinces, with cast, instead of wrought, iron rails. This project very happily never came to anything, and, with its abandonment, it became obvious that the works would never pay by the manufacture of cast iron alone; attention was accordingly directed to puddling and the manufacture of wrought iron. Mr. Ramsay, the manager, consequently made an estimate of its probable cost. And it is sufficient to state that he estimated in 1863 that a ton of wrought iron would cost Rs. 126-14-6 at the seat of manufacture, to shew how impossible it is that the works should now pay. In previous times, when iron rails cost as much as £13-7, and steel rails £18-10 per ton, the manufacture in Northern India might, perhaps, have been worked remuneratively; but steel rails have recently cost in England no more than £5-7-6 a ton, while there is no reason to suppose that the manufacture of iron at Kaladoongee, Ramghur, or Dechouree, would cost one farthing less now than fifteen years ago. Mr. Ramsays' estimate, it should be said, is likely to be more reliable than that of any other person. Mr. Ramsay was an expert. He had been practically engaged in iron manufacture in Sweden, where the ore, as in the Kumaon hills, is very rich, and where also, as in the Kumaon hills, the fuel used is charcoal; and, further, he was two years on the spot. There were managers before Mr. Ramsay, and there has been at least one manager since; but Mr. Ramsay is the only manager who can be said to have had practical experience of the exact sort required. In the recent experiments, the manager, though well acquainted with castings and the manufacture of small articles from iron in a commercial form, had, we believe, no more experience of producing wrought iron from the ore, than could be learnt in a six months' visit to England. He was besides engaged in his substantive duties in the Roorkee workshops, some 80 miles off, and could, therefore, only devote a small portion of his attention to Dechouree. But we venture to say, that if he had been on the spot, no other result than failure could have occurred. Where Mr. Ramsay failed, neither he nor his subordinates were likely to succeed. The mistake was his undertaking, at the instigation of the North-West Provinces' Government, the charge of an enterprise which was hopeless. And the Government of the North-West Provinces, even with the approval of the Supreme Government, who sanctioned the expenditure, were, in our opinion, mistaken in embarking in an idle venture. A comparison of prices in England and in India, such as we have made, is indeed sufficient for an adverse decision, more especially when Mr. Ramsay's estimate is a guarded one. At that time (1863), English bar iron delivered at Futtehgurh or any of the larger marts in the North-West Provinces, cost Rs. 140 to 150 a ton, and, therefore, there was a profit if Indian iron cost no more than Rs. 127; but this cost, Mr. Ramsay says, "does hardly cover the interest on "the capital, and in the event of being confined only to the "Bhabur ores, the iron manufacture at this place will never "pay." The Bhabur, it should be mentioned, is the lower ground at the foot of the hills in which Dechouree is situated, but its ore yields only 30 per cent. of metal, and has, consequently, to be mixed with ore from Ramghur, which yields 60 per cent., in order to produce a good quality of iron. But

Ramghur is 25 miles distant, and carriage expensive. Moreover, as regards fuel, though Mr. Ramsay estimates that the area of forest granted by Government is sufficient for the supply, he adds, "a great number of roads and bridges are "necessary to make all parts of the forests accessible." There are, therefore, great difficulties in the way of the manufacture of iron, and unquestionably it cannot be made at the present English prices at a remunerative cost. Of that there is no doubt; but supposing that steel or iron rails could be made at a somewhat less outlay than in England, the nearest point o[illegible]very on a line of railway—and railways can alone carry weighty articles cheaply—is Moradabad, some 50 miles distant from Kaladoongee, by a road on which there are two rivers only partially bridged. Carriage to any market would, therefore, under present circumstances, entirely swallow up any possible profit, and nothing less than communication by rail with the seat of manufacture could make its products saleable. It is quite certain that a company which has no capital, cannot build such a line of railway; and that if it could, the works would be so weighted that they could not pay. To hope to raise capital for such a purpose would, therefore, be impossible, and, if possible, wrong. It is equally certain that Government would not be justified in building a line of railway simply for the purposes of iron manufacture; and there is no sufficient reason for building it on any other ground, while so many more important communications elsewhere are needed. The conclusion we come to is simple,—that if Government desire to pecuniarily aid the establishment of iron manufacture in India, the money must be spent elsewhere than in Kumaon. The Bengal Iron Company has works absolutely on a line of railway, and its success in producing iron of a good quality is established. But if the works are really to answer, wrought iron must be manufactured, with all the necessary outlay of puddling furnaces, rolling mills, and so forth. We believe that in the recent experiments in Kumaon, since 1876, no less than Rs. 1,50,000 have been expended; a sum which, as proving what ought to have been already appreciated by past experience, we consider to have been thrown away. The same sum expended in Bengal might have had very different results, and have shown that what is impossible at present in one place, is elsewhere quite practicable. It might, of course, have had precisely the same result as in Kumaon; but even then the money would not have been spent in killing, as it were, what is already dead, but in really gaining information and experience.

THE ENGLISH PLOUGH IN MYSORE.

IN a former issue we informed our readers that the Mysore Government had, after two years delay, permitted Mr. Harman, the Superintendent of the Bangalore Experimental Farm to proceed on tour, to see something of the agriculture he is brought out to improve. At his own request he was allowed to take with him an English plough to see if, when shown them, the ryots would be convinced of its utility. We learn that the result of a four months' tour through the Mysore, Hassan and Kadur districts of Mysore, is that over three hundred applications for similar ploughs hade been received. In one case no less than 40 were asked for in one taluk, where an Englishman has been using English ploughs for the last two seasons and obtaining in consequence very considerable profits by cultivating wet land.

It has been so much the habit to run down the ryot and call him conservative and pig-headed, that we cannot help thinking after this unlooked for sign of advancement, that the attempts at improving agriculture hitherto made in India have been frequently misdirected. The ryot is a stay-at-home individual and will not put himself out of the way to visit model farms, and much of the disappointment that has been felt by those trying to reform him may have arisen from this cause. Cheap agricultural reform is much wanted, and it is a question for consideration whether other agriculturists might not follow the lead of Mr. Harman; and instead of writing long reports and experimenting on farms the ryots never visit, go boldly through the districts and practically show what they can do. This tour has proved the ryot's eye more keen than his ear, and has disproved the fallacy that only the very best bullocks in the country can drag an English plough, for in all cases Mr. Harman used village cattle to draw the plough, after illustrating its use with the trained cattle that he took with him. The Madras Government employ three highly paid Europeans to look after the Sydapet Farm. In our opinion one of these might well be spared to tour about in the ploughing season, when he would not only show the ryots that it is possible to improve their agriculture and give the plough as an illustration, but also learn himself what are the real difficulties in the way of an improved agricultural practice. The reports which have hitherto been written too often contain assertions by those who have had no practical grounds for forming an opinion, and the ryot's side of the question is never ventilated. Again, if the ryot were convinced by ocular demonstration that one reform was good, he would gain faith and listen to other improvements, such as cattle-box feeding, manuring and agricultural advances, which cannot like a plough be shown from place to place.

Mr. Harman's success opens a wide field for speculation, and as we learn he intends in a future tour taking with him a model of a double mhote and other machines, we shall await with interest this report on his doings during the past year.

EDITORIAL NOTES.

A STRIKING token of the progress of agriculture is the display of commercial manures, in the Paris Exhibition. They do not pretend to replace farm-yard manure, but to aid it as auxiliaries. The specimens are shown in bottles, bearing a label showing the price of the manure and its chemical analysis. A quarter of a century ago, such a display would not have been possible; the trade in manures is now considerable, thanks to science and the law. The fertilising properties of guano, fecal matters, animal refuse, nitrates, earthy phosphates, oil-cake, and the residue from various industries, are not contested; the point is to know their value; to apply them where necessary, in suitable quantities, and at propitious seasons. There is one point in connection with these auxiliary manures rather lost sight of—their degree of pulverisation. The finer the manure, the more efficacious will be its action, because the plants can more easily incorporate and absorb it. Glass, for instance, which is insoluble in water, becomes dissolved therein when reduced to an impalpable powder. In selecting a commercial manure, give the preference to that which is the most minute state of division, just as you would prefer for seed, the soil which is the most friable. Hence, the importance of machines which reduce mineral fertilisers to the condition of a flour.

THE good results obtained in Holland and elsewhere from the application of sea ooze to moorlands and sand-drifts have led to a proposal for utilizing the material of a similar nature which is dredged up at Bremerhaven, and which has hitherto been thrown away or neglected as valueless. A preliminary chemical examination has shown it to be possessed of considerable fertilizing power, chiefly due to the presence in it of dead marine animals and plants in countless numbers. When newly dredged the ooze contains more than half its weight of water, but loses the greater part of this when laid by for a time, and so becomes much easier of transport. At first, too, it cannot be applied to agricultural purposes, as it contains materials which are destructive to vegetable life, but these are effectually decomposed in time by exposure to the air. In 57,500 kilogrammes of Bremerhaven ooze, which is about the quantity applied to a morgen of land in East Friesland, there are found 88 kilogrammes of nitrogen, 68 kilogrammes of phosphoric acid, 240 kilogrammes of potash, and 1,963 kilogrammes of lime. Here is a hint for us in India. With the extensive seaboard we possess, a thorough examination of the sea bottom around our coasts might have valuable results. Surely the matter is worth consideration.

A COURSE of lectures on Practical Botany will shortly be commenced at the Central Museum at Madras. One or two of the early lectures will be devoted to the elements of the subject, including classification and the method of distinguishing plants. The remainder of the course will be devoted to the description of the more important plants of Southern India used in the arts or as food or cultivated in gardens. Attention will be given to the modes of propagating and rearing plants under culture, and special descriptions will be given of those yielding or likely to yield commercial products. The lectures will be illustrated by specimens of plants and their produce, and by models and drawings. They will be delivered on Saturday mornings at 7 A.M.

The Government of Guadaloupe have offered a premium of 100,000 francs to the inventor of a process to obtain a yield of over fourteen per centum from sugarcane. The competition is open until June 30th, 1880. It is not for an improvement on sugar mills, but for the discovery of a process bearing upon the yield of turbinated sugar. All the expenses of transit, putting up of machinery, or implements are to be borne by the inventor. Such an invention would add many millions to the wealth of Guadaloupe, to say nothing of Cuba, our own and other sugar-producing countries.

The American Minister for Agriculture has recently stated that in the extensive caverns of Texas enormous mases of guano are deposited. The quantity estimated at 20,000 tons, and the quality is said to be superior to that of fish guano. Its origin must be looked for in the immense number of bats which inhabit these caverns.

It has been proposed, by whom it is not stated, to the Khedive of Egypt to convert into paper the cloth of the mummies, of which it is calculated 420,000,000 must be deposited in the pits of Egypt.

Very little is known to the public of the Zemindary of Ettyapuram, in the Madras Presidency. The ruling zemindar is an intelligent youth about twenty-two years of age. His estate comprises an area of 535 square miles, and yields an income of over three lakhs of rupees yearly, and it is free from debt, chiefly owing to the careful manner in which his predecessors managed it, with the aid of the Court of Wards. Just two years ago an experimental farm was opened in this little estate, under the superintendence of Mr. Crowther, trained in the Government model farm in Madras under Mr. Robertson. This was established by the Court of Wards. It is now looked after by the zemindar, with the aid of the manager, Mr. Kuposawmy Chastriar. Seventy acres of land have been fenced in, of which 50 acres have already been cultivated. The land is ploughed with English and American ploughs; the natives now use the English implements with ease. Cattle breeding is going on famously also; the breed of Mysore bulls is being tried on the farm, and there is hope of success. American cotton has been tried, and is thriving beautifully, but the ryots seem to prefer the country cotton.

Consul Churchill, in his report on the trade of Ghilan in 1877, gives an interesting account of the condition of the people in that part of Persia. Tilling a rich, fertile soil, they get an ample portion of the produce of the land for their pains. If they engage to clear a piece of jungle, they divide the produce of the land with the owner of the soil. If mulberry trees are planted, any silk produced, the peasant rears the worms and gets a third of the produce for his trouble. As little supervision can be exercised over the villager, he naturally contrives to secure for himself a good portion of the crops. He has advantages from his agricultural vocation, which are not inconsiderable. He can cut down wood in the jungle—that is, the neglected part of his landowner's estates—and sell it on his own account. His cows and sheep can browse freely in those parts that are not under cultivation. He can make charcoal, produce vegetables around his hut, rear and sell poultry, and dispose of the fruit which grows in abundance on the estate, without consulting the owner of the land. The taxes are not farmed out in Persia as they are in the Ottoman Empire, and though the collectors contrive, as a matter of course, to extract some 10 or 20 per cent. more than they are entitled to from the tax-payers, they are satisfied if those limits are not exceeded; and there really is not a system of oppression, though here and there cases occur in which complaints are made to the superior authorities. When the tax-gatherer grows rich, he is pounced upon by the Governor, who makes him disgorge, and who, in his turn, is called upon by the Shah, to pay large presents on his appointment, or heavy fines for reported malversations. It has been calculated that in India the income of the native peasantry averages £2 a year; in Ghilan it is from £5 to £9. Rice, the principal food, is abundant, and very cheap. Mutton is at 3d., and beef, 1½d. per lb.

The entrails of cattle are now manufactured into cord, rope, round and flat belting, and other material where extraordinary strength is required. The process of manufacture is thus described:—"The entrails, which will average about fifty-five feet in length are first thoroughly cleaned and then placed in vats of brine, where they remain for some days. When thus prepared they are not much thicker than a piece of common cotton twine, and will sustain a weight of about ten pounds. The next stage in process of manufacture is to wind the prepared material on bobbing, after which the process is the same as in making common rope. This method is used to produce a round belt; but where a wide flat belt is to be made, a loom is employed, and the five strands are woven together, as in ribbon manufacture. The flat belts are made of any size, and the round sizes vary from one-sixteenth of an inch up to one and a half inch in diameter. The round belts are made either in the form of a smooth cord or as ropes with from three to five large strands. The three-fourth inch rope is said to stand a strain of seven tons, and is guaranteed to last ten years. Hemp rope will last on an average not over three years. Three-eighths round cord, containing 150 strands, will endure a strain of about four tons."

A gentleman, writing from Colorado, gives the following interesting facts about Colorado wheat:—"The yield of wheat per acre throughout the State is from twenty-five to thirty bushels. but there are localities where three times that amount is produced, Governor J. L. Routt showed me, while at his office, samples of Egyptian, which, he says, yielded eight-five bushels to the acre. This seems like a fabulous yield, but it is undoubtedly true, as the governor is a very reliable gentleman. He also exhibited samples of white Australian wheat that yielded as high as sixty bushels to the acre. The Egyptian is a peculiar looking wheat. The principal head is of ordinary size, with a cluster of four or five smaller heads projecting from the lower end of it, and the kernels are so very large, and their numbers so numerous upon each stalk, that the enormous yield is more easily accounted for. The white Australian has a very large head, and the kernels are in a cluster of three on each side of the stalk, and each head contains from eighty-five to one hundred and fifty kernels. All the samples (and he had many on exhibition), were the largest and finest I have ever seen. The wheat is all of a bright yellow or golden colour, instead of the dark red colour of our Minnesota wheat, and the kernels are large, plump, and hard, and average at least one-half larger than the Minnesota wheat. It makes a fine flour of a bright golden tint."

In the celebrated palm-group, in the Peradenya gardens in Ceylon, two towering talipot palms have been displaying for several months their gigantic plumes of flowers; unfortunately these fine trees will soon die after the ripening of their numerous seeds; and after proving, to the delight of visitors, glorious ornaments of the garden, for a period of nearly forty-years. The height of the largest of these trees, including the flower-panicle of twenty-two feet, is 105 feet; the circumference of stem with persistent bases of leaves, at three feet from the ground, 13 feet 9 inches; of naked stem, at twenty-one feet from the ground, 8 feet [illegible] inches. It is gratifying to know that there are other specimens of this fine palm to come forward as their worthy successors, in due time.

A correspondent writes from Negombo:—"I venture to say that 1879 will be the greatest cocoanut year ever known in Ceylon. In all previous years in this district, from the middle of July to to the middle of October, very severe droughts generally cause the branches and young nuts to fall from the head-stems of the trees. But this year there has been constant rain up to middle of September, so that nothing can be finer than the appearance of the foliage of the trees—no dry branches to be seen anywhere, and the young shoots or spathes are well stocked with young nuts. There can be only two drawbacks, severe drought after so much rain or very high winds, or the missing of the approaching monsoon, which would put all things out of order. It is rare, indeed, to record such two years running as 1877 and 1878, as the general rule of the Ceylon climate hitherto has been a short fall of rain, succeeding a heavy one, no two monsoons succeeding each other since 1863 shewing such results."

THE establishment of plantations of eucalyptus in certain Algerian plains hitherto innocent of trees, has been followed by unforeseen consequences of vital importance to many of the colonists. For, besides their vaunted beneficial action in purifying the air and moderating the heat, these plantations have had the further effect of attracting countless myriads of sparrows, whose depredations have reached a point of very grave severity. An Algerian paper, the *Akabar*, says that imagination fails to form an idea of their number; the trees are covered with their nests, and their ceaseless twitter and chirp may be heard at a distance of eight kilometers, like the sound of a stormy sea breaking on the rocks; and their appearance, as they set out at morning in search of food, is like that of a large black cloud when thunder is threatening. The whole of the rural population is obliged to keep watch and ward over their fields, and the slightest intermission is quickly punished by the total loss of their crops of wheat or oats. The colonists wage war incessantly; they feed on sparrow dumplings and sparrows' eggs, they throw sparrows to their dogs and pigs, and yet "the cry is still they come." In fact, says our contemporary, the French have conquered the Arabs and won their colony, only in their turn to be conquered by the sparrows.

M. GRANDEAU, Director of the Eastern "Station Agronomique," and one of the Professors at the School of Forestry, at Nancy, has just communicated to the Academy of Sciences, his most recent observations relative to the influence of atmospheric electricity on the nutrition of plants. His experiments, commenced in March of last year, were made upon tobacco, giant maize, and Chiddam wheat, and their general results are summarized as follows: 1. Atmospheric electricity is an important factor in assimilation in vegetable life. 2. Plants submitted to its influence elaborated in a given time, other conditions being equal, from 50 to 60 per cent. less of living matter than those whose growth proceeded under ordinary circumstances. 3. Vegetables but slightly elevated above the level of the soil are equally influenced by atmospheric electricity. 4. The percentage of protein matter formed does not appear to depend sensibly upon atmospheric electricity. 5. The percentage of ash is higher in plants that have grown unexposed to it. 6. The percentage of water is less in such plants. M. Grandeau announces his intention to continue his studies in the same direction, more especially with reference to the influence of the presence of trees upon surrounding vegetation.

THE English horticultural journals have reported recently several extraordinary results achieved by grafting experiments. Amongst others, the Jerusalem artichoke has been grafted upon the sunflower, and the latter in due course produced "small tubers at its usually fibrous roots." In another case the common potato, or rather the haulm of potato, was grafted upon a tomato vine, and the result was "a number of small green tubers at the axils of the leaves of the potato." Men of leisure derive pleasure following up such experiments as those mentioned. They have photographs made from their favorities: discussion ensues and "important results are expected to follow."

THE report from Washington, dated October 14th, to the effect that the American Agricultural Bureau, estimates the outturn of cotton at 5,250,000 to 5,500,000 bales, deserves attention. This is the largest crop ever offered for sale by America. It must, as a matter of course, largely affect in prices in all parts of the world, and especially the prices of inferior staples. It looks as if the efforts made by America to regain her old supremacy in the cotton-market are likely to be successful.

Mr. ROBERTSON points out in his latest report on the Sydapet Farm, that many mineral substances are yet unutilised in this country for the purposes of agriculture. Up to very lately the refuse of the slaughter-yards of Madras was entirely wasted. Mr. Robertson ascertained that in Madras about three thousand head of cattle and 220,000 sheep are killed annually in the Municipal slaughter-yards. The population of the city, as taken at the last census, was 397,552 persons of whom probably 17,500 are not meat-eaters leaving 380,000 souls to be provided for with flesh meat. The amount of butchers-meat consumed by the people is small, chiefly owing to their poverty. A pound of meat supplies for a whole day a Hindu family of six persons. The offal and blood of bullocks slaughtered make very valuable manure—the blood is said to contain 80 per cent. of water and 20 per cent. of solid matter, rich in nitrogen. One half of the ash of dry blood consists of common salt, the remainder of the ash is chiefly phosphate of soda and phosphate of lime. According to the calculations made by Mr. Robertson the whole refuse of the cattle slaughtered in Madras should be worth at least Rs. 6,000, of which Rs. 2,500 would be the value of the dry blood. The Agricultural statistics of the presidency do not show the number of sheep in the country in any year since the census of 1871-72 was taken, when the stock of sheep was returned at 6,745,000. In 1869-70 the number of sheep was shown to be 6,196,000, giving an increase of 549,000 in two years. Mr. Robertson thinks that fully ten per cent. of farm stock succumb to disease in each year and that 2½ millions of sheep and goats are killed in the whole presidency in that time. If such is the case, the refuse offal from these would yield Rs. 18,000. Of late the Madras Municipality has begun to sell the offal of the different slaughter houses in the city. When tenders were called for, a coffee-growing firm in Ceylon tendered and obtained the contract.

AT a recent meeting of the Society for the Encouragement of National Industries in France, M. Basset read a paper on the researches which he has made to discover a means of obtaining ammonia at a low price and on a large scale through the medium of the nitrogen of the atmosphere. This question, of such importance to agricultural interests, has been the object of M. Basset's studies for more than a quarter of a century. The problem he proposed to himself was to generate hydrogen under moisture in the presence of nascent hydrogen. After explaining the various methods employed in his attempts to provoke this reaction, M. Basset announced that he had ultimately arrived at complete success, and was then in a position to turn out ammonia on a wholesale scale at the rate of five farthings a pound, and sulphate of ammonia at about four-fifths of that price. At the same time he deposited in the office a full description of the system he adopts which was referred for examination and report to the chemical committee of the society. It need scarcely be said that if M. Basset's reported discovery is capable of practical application on the scale that he confidently believes, a complete revolution is at hand in the artificial manure, trades and kindred industries.

SOUTH Australia has carried off the first *diplome d'honneur* for wheat at the Paris Exhibition, the jury describing its exhibit as a '*collection magnifiqne*;' also a good medal for flour. It sent seven specimens of wheat and flour, and to each a prize has been awarded. Adelaide wheat obtained a gold medal in 1851, and has always fetched the highest prices at Mark Lane.

A CURIOUS fact, interesting to sericulturists, may be recorded. Among the collection of Indian products sent to the Paris Exhibition were a number of cocoons of the Tussur or wild silkmoth of the forests (*Antherea Paphia*); some of these chrysalids have produced living moths in the cases, and the females have deposited their eggs. In the collection of silk sent from Western Australia, one of the exhibitors had formed the name of the colony with silkworm's eggs, and the eggs not having been killed, have all produced worms.

A PLANT which belongs to the family of the Restaceæ, known to botanists as *cariaria thymifolia*, a native of New Grenada, yields a juice which appears to form a very good writing ink, without any particular preparation. The juice, when first obtained, does not attack steel pens as ordinary ink does; the characters written with it are at first red, but in a few hours become very black, and then it is found that it resists the action of chemical agents much better than our ordinary writing ink does. It appears, however, that its resisting properties in this respect are far from perfect, though better than those pertaining to common writing ink.

JAPAN is the only country in the world, at all advanced in civilisation, where sheep are not found. Mr. D. W. Ap' Jones, an American who has resided there since 1873, has been engaged for some time past in the introduction of sheep, and writes an interesting letter on the subject. Mr. Jones states that he is superintending a farm of 7,000 acres, on which there are now about 4,000 sheep, chiefly of the Mongolian and Shanghai breeds. On the day of writing, June 1, he was to entertain a party of Japanese to celebrate the birth of the first thousand lambs dropped in Japan. Nearly two-thirds the area of the Empire, he says, "is wild and uncultivated, and it is only through the medium of sheep-raising that this vast area can be succesfully brought under cultivation. But the matter of acclimatization is very interesting. The animals require the greatest care, as there is no climate analogous to this in the world from which sheep could be brought."

Boussingault, when a young man, made a scientfic tour of Central America, and Humboldt directed his attention to the milk tree,*or "cow tree," as the Spaniards designate it, which attains a height of fifty to sixty-six feet. When an incision is made in the trunk, a white viscid liquid exudes, of an agreeable flavor. The soldiers "milk the tree," by gashing it with their sword, and receiving the refreshing sap in tins; it is added to coffee and chocolate; the natives drink it like milk, and dip their maize bread or casava in it. When exposed to the air, it soon becomes rancid, and forms a cheese. Boussingault has just analysed some samples of the milk shown in the Paris Exhibition by the Venezuelan Government. Its composition very much resembles ordinary milk; it is peculiarly rich in fatty matters and phosphates, and contains abundance of sugar.

Manioc planting for the manufacture of tapioca, is coming into vogue in the Mauritius. It is believed that this cultivation will give good results; but the speculation is still in its infancy.

COMMUNICATED AND SELECTED.

INDIAN CORN.

We make room this month for the following exhaustive papers on the cultivation, grinding, and general treatment of Indian corn, addressed to the Straits Government by the American Consul at Singapore, Major A. G. Studer, with a view to directing the attention of planters, agriculturists, and others to this hardy and easily cultivated cereal, which is so valuable as a food-grain.

Consulate of the United States of America at Singapore.

August 15th, 1878.

Sir,—I have the honor to acknowledge the receipt of your letter of the 10th instant, instructing that the Government of Perak is desirous of establishing in that State a central mill to which the people could bring their Indian corn to be ground, and asking by direction of H. E. the Governor, whether I could give any information regarding the American method of preparing that grain, and, further, that His Excellency would like to have the names of any books on this subject, and requests me to state where they can be procured.

Most cheerfully will I furnish you with such information as I can give upon this, or, at any time, upon any agricultural subject with which I am familiar and regret that owing to very pressing business, requiring immediate attention, I could not have given you the desired information much sooner, an information, too, upon a subject with which I had for several years every opportunity of becoming familiar.

As to books, asked for by His Excellency, on the subject named, I regret to say that I could not at present *name* one, treating exclusively about the treatment of corn, or the process of grinding, and even if I could I fear that owing to differences of climate and soil, that which could hold good in America, might not in this region. However, if the Government of Perak has already procured a corn mill, would suggest that the manufacturer of the mill, especially if the mill has any peculiarity or process not common with other mills, give all needed information on it. If the mill has not been procured as yet, I would recommend that, in ordering one, the condition be made, that the manufacturer furnish most thorough and closely descriptive information as to the whole process of grinding corn, from beginning to end; also as to the treatment of the mill itself, the cleaning of the stones and the hewing of the same (if Burr-stone and not iron.) The firm of George L. Squier & Co. at Buffalo, State of New York, is one of the most prominent mill and plantation machinery manufacturing firms in America. They manufacture both iron and Burr-stone corns mills and I have no doubt they would very gladly give all necessary information upon the subject.

The *conditio sine qua non* in corn-grinding, whether for [illegible] kilings (crushed corn,) mill or hominy, is that the corn be brought hard and dry to the mill; it cannot be too dry, and care should be taken in harvesting that the corn be not removed from the stalk, nor husked before it is perfectly hard, nor gathered during or shortly after a rain. But this being a tropical climate, and the atmosphere greatly charged with humidity, and rules, ways, and custom practised in the United States when and after gathering a crop of corn, being hardly or only partly applicable here, I will, not having time *now*, as soon as I possibly can, endeavour to write an essay upon this whole subject for the benefit of all concerned in corn-planting in the Malayan States, hoping it may prove of some use to H. M. Residents in the Malayan States, in their endeavour to guide those planting corn.

All corn to be ground into meal (*i. e.* the kernels of the ear) must be first "shelled," which means removing the kernels from the cob. People having corn ground for the purpose of making "corn-bread" or "porridge" (mush as we call it in the Western States,) *i. e.* boiling water poured over meal and allowed to stand until cold, when the water is poured off only, can readily shell a sufficient quantity to last them a few days. In this climate unless one has tin cans, tightly closed, to preserve the meal against dampness and insects. I would not advise them to have much corn ground at a time. In fact, it does not matter how much meal one requires for bread-making or stock-feeding, *in this climate* he must take such care of it that the air can have no access to it, else it will soon sour and be only fit for food to swine. In the Western States of America, the large stock farmers, *i. e.* farmers that cultivate large tracts of land with corn and cereals generally and raise herds of horses, cattle, sheep and swine, and who find it more profitable to feed corn meal (and it is far more profitable) that *corn in the ear*, could not find hands and time enough to shell their corn by hand, and, therefore, keep a corn "sheller"—a machine that can be run by a boy twelve years old easily. He throws the corn into a large hopper, turns the crank, and the shelled corn and the cobs run out separately below.

A few years ago, some careful and economical stock farmers made the discovery that the corn cob contains a not inconsiderable amount of nutriment, had corn in the ear (whole) crushed, ground into meal, and found that stock of all kinds liked it and fattened well on it. As a sequel, mills were invented (different patents) so arranged that a farmer can grind whole ears of corn, or shelled corn, into meal at his option, with an attachment for shelling corn. Many such mills can be found throughout the Western States, run by wind, water, horses or oxen or even by hand. A mill of that description I would recommend as most beneficial, centrally located in the State of Perak, and the grinders to be made of iron, instead of stone, because firstly, unless the stone is very hard, of superior quality, it will wear, which means that grit will mix among the meal and render it unpleasant for food; secondly, a difficulty would probably be experienced to find any one, unless he be a regular miller from Europe or America, that would know how to dress the stones; thirdly, iron grinders, if in any way well taken care of, will wear out very slowly, and when worn out, can be easily supplanted by new ones.

Corn ground into meal does not undergo the same process as wheat, *i.e.* the hull or outer skin is not first removed, but the kernels are crushed and ground into meal at once; only in the case of "hominy," which is simply corn with the outer skin polished off, and the kernels eaten *whole*. For hominy special mills are used, as well as only *one* species of corn distinguished for its great hardness and known under the name of "White Flint corn," and it makes excellent meal as well.

Corn meal, before it can be made into bread or porridge, must be sifted in sieves made of hair-cloth or fine wire, just coarse enough to let the meal pass through and to retain the "bran" or skin, a process which is not necessary, when feeding meal to stock.

Finally, Sir, a great deal depends, to make the enterprise a success, upon the fact of having good species of corn. For this climate, judging from past experience in America, and considering the soil and climate, I would recommend two species known as "white flint" (already named), and "dent corn", white or yellow. These two, especially the dent variety, the ear of which is much larger, would be a valuable acquisition. There are other species also good that I tried, but none yielded so well, or proved so beneficial in every respect, as the two named, and if His Excellency is desirous of obtaining good and pure seed of the same, I will most cheerfully procure it in such quantity as he may direct to be procured.

I seize the opportunity to congratulate the State of Perak upon this enterprise. Truly, and I have said it often, there is hardly anything that will contribute faster to the health, wealth, and abundance of a country, especially when being newly developed, than the cultivation of corn. Not only is it very wholesome and nutritious, stock, blades, and grain tending to keep stalk in excellent order for draft or the meat market; but I know of nothing better, as a change of crop or to plant on newly cleared land than corn, and as regards the husbandman and coolies engaged in all kinds of manual labour, they will receive more nutriment, be stronger and healthier, from corn-bread or corn-porridge with milk, than from rice, curry, or fish. Besides in this country, corn receiving a little attention while growing is a certain success on fair soil in about 60 days, and is easily harvested, which cannot be said in like manner of rice. The ground, the harvest over and the tough portions of the stalks removed, is then ready for another crop, either of tobacco, rice, sugar, tapioca etc., and will have been greatly benefitted by it.

A. G. STUDER,
U. S. Consul.

The Hon.
The Colonial Secretary, S. S.

This hurriedly written Essay, with all its short-comings, is most respectfully transmitted to His Excellency, Sir William Cleaver Francis

Robinson, Knight Commander of the most Distinguished Order of St. Michael and St. George, Governor and Commander in Chief of the Straits Settlements, by Major A. G. Studer, Consul of the United States of America at Singapore, for the benefit of any one in the Straits Settlements and the Malayan States, who may find anything in it of advantage to him, and to be used by His Excellency as he may deem best.

Essay on the Cultivation of Indian Corn.

Soil.—Corn will grow on any soil that contains enough of fertility to develop and mature it; or, where, if sufficient or more than sufficient fertility exists, the cultivator is not shy of labor or expense to make those preparations which are its cultivation a success.

The soil best adapted for this cultivation is a loam containing sand, known as "sandy loam," under which, whatever may be the thickness of the top soil, the subsoil is a clay sufficiently mixed with sand, to render it porous. The best corn-lands I have noticed in the Western Prairie States of the United States, is a deep vegetable mould mixed with sand, with a porous subsoil of the sandy clay. Corn, being a cereal, that wants only enough of moisture to insure its full development, such soil, in addition to its extreme fertility and warmth, has the advantage of absorbing in a short time a superabundance of rain water, as well as during dry spells or drought, to give egress to the moisture in the subsoil through evaporation, also, after being stirred a little, to receive and diffuse the dew. I have known such lands to produce as many as 80, and with very careful cultivation, between 90 and 100 bushels (one bushel of corn in the ear is about equal to 52½ catties); whereas 45 bushels per acre is a fair average yield in the corn-producing States. The deep alluvial soils, which are always mixed with sand more or less, have the same result, especially on the banks of the lower Mississippi, and several of its tributaries, known under the name of "river bottoms," which mean flat land following the bank of a river. All "river bottoms," however are not alluvial lands. A river bottom, above overflow, in spring or during the rainy season, with hills, mountains, or undulating heights for at back ground, is generally mould or loam land, with clay, or marl, and, occasionally, with sand or gravel subsoils, all depending on the proximity of the elevations named to the river and the nature of such elevations. Alluvial bottoms are, with rare exertions, lands that are subject to overflow. whether the current flows over it or whether it is produced by "backwater. The latter, or backwater bottoms are by far the best, simply, because the backwater, or water pushed during great freshets up to the small tributaries of large streams, lays quietly like the water of a pond, and recedes slowly agreeably with the fall in the main-channel, leaving behind, especially in timbered countries, very rich sediments. I have seen farmers in parts of the Western States, after having overflows late in spring, and finding that they had neither the time nor the means to plough such bottom lands in time to plan their corn, in order to mature in before the setting in of early frosts in autumn, to simply mark their lands, as they always do, for corn-planting, and then plant their corn into such sediments, and plough it afterwards (between the rows); after the corn had sprouted, with cultivators, whereafter they gave it a good hoeing once or twice, and secured good crops. I tried it myself with excellent results. It must, however, be remembered that the sub-soil water rich sandy loam to a great depth, and that I would not advise any one not thoroughly familiar with lands, corn-planting and the nature of the corn itself, to do the same, and only present it as a matter of illustration.

Alluvial bottom lands, subject to overflow with a heavy current or rush, can only gather fertility so long as they are covered with a dense growth of timber, and may in time gather enough to rise above overflow. Such lands, while subject to overflow, should never be cleared for cultivation, unless those that clear them, dam them up sufficiently high and strong to resist an over-flow, because, if not dammed, the vegetable rubbish broght by a current cannot fix itself is swept away, but, more than all, the topsoil, generally mould, is washed away. Channels are formed that gradually widen and deepen into rivers, producing islands, which often are gradually washed away. The best crop such over-flow lands can produce is the very timber itself, which, if properly husbanded—*i. e.* the big trees cut down and the saplings allowed to stand, will never fail to yield. This description of alluvial lands or bottoms, consists generally of heavy clay or marl, a fat bluish grey or whitish clay containing little or no sand, rather fine grit, and has a few inches of vegetable mould on top—all depending on the speed of an overflow current. They are generally marshy and, no doubt, very fertile, but I could not recommend them for the cultivation of corn, unless one is willing to dig deep ditches, running parallel, in pretty close proximity to each other, and connected again with so called "blind ditches," running across the main ditches at right angles, *to carry off all the water that gathers between the light top and the heavy fat clay or marl sub-soil, that is not porous*, the main ditches should be at least four feet deep and wide enough for a man to walk at ease in them, while the cross or "blind ditches," (the latter are only required where people work with ploughs) should be at least 18 inches deeper than the topsoil, or, about two feet in depth and 15 inches wide, running parallel with, and in sufficiently close proximity to each other, to completely drain the land, so that after heavy rains water should never stand over 24 hours at furthest on the land, which is very long; if it does, then it is a sign that the ground is not yet sufficiently drained. Since I came to Singapore I have so often heard people say of lands, which I felt certain to be the richest of, "Oh, this is no tobacco land; one must go here or there to insure success," and they were quite right, as long as they did not know any better, had a narrow conception of agriculture, and only judged, because it had never been tried by those that do know something about it. Some tried planting on rich bottom soils, clay lands, ditched it one way, big deep ditches at that; perhaps they made cross ditches also; but if they did, not, close enough together, in the first place; and in the second, working only with hoes in heavy soil, they could not pulverise it, or make it fine, the tender root of the tobacco could not push, and during dry weather, the land, worked into big lumps, got as hard as a sun-burnt brick, and no wonder "it would not grow," The most astonishing to me was the reason attributed for the failure of the crop, *i. e* that "it was too near the salt water." So it was, no doubt; and too far from sound judgment!

For the benefit of such as have never planted I would suggest, that corn and tobacco require as nearly the same soil, the same preparation of the soil and cultivation, as any two plants of different variety and similar tendency do require. Where tobacco for any reason does not grow, corn will not, or will only make a sickly stunted crop. On such heavy swampy clay lands as I have described, unless well drained, and thoroughly cultivated (*i. e.* the big lumps must be broken and the land made fine) corn can never make a crop worth talking about. If planted during fine weather and no heavy rains setting in before it has sprouted knee high, and thoroughly well hoed before it has that height, it will grow slowly, the stocks will be very thin and will make tossels at a height at which sound corn, on proper soil, will be only at half the regular height (when corn makes tossels it is a sign that it has reached its full height, or very nearly.) The blades and upper half of the stalk, instead of being of a rich deep green color, is of an uncertain green or yellow. Examine the ears, when "in milk" (*i. e.* just before maturing into hardness) and one will find that there are only a few kernels, standing losely on the lower half of the cob. Under such circumstances the greatest benefit to be derived from "such a crop," is, to cut it while still tender and juicy, and to feed it, stalks and ears, to cattle, sheep, and swine.

On the peninsula of Malacca, where rain squalls are of such frequent occurrence, and the rainfalls the most copious imaginable, and often long lasting, all lands, to be cultivated, or for a short time under cultivation, should be drained, even if they were the best loam lands, with porous subsoil and undulating at the same time, not only for carrying off the surplus water, but also for preventing the under washing of roots and the falling of corn or tobacco stalks, which is occasionally the case when rains are accompanied by strong gushes of wind. Such good lands require no cross ditching or only in cases of fields being very large and much longer than wide.

To recapitulate it, let any one, before planting corn or tobacco, examine the soil well, not only in one but several places within an area ready for cultivation. If it is found that the topsoil (mould or loam) is not sandy it is a pretty sure sign generally, that the sub-soil contains no sand; then, the land should be well cross ditched. If the topsoil is sandy, or from four to twelve inches in depth, and the sub-soil is a stiff clay, containing little or no sand, or only fine grit, that land must be cross ditched, but the ditches need not be drawn in such close proximity to each other. One must be guided by the surplus amount of water standing for an unreasonably long time after a heavy rain, and the very places in a field, where water stands in largest quantities. One must also be guided by the rise or fall—the declivity of his land. Experience, on the spot, in such matters, is the best teacher.

I spoke of "blind ditches," or covered ditches. If a planter uses ploughs and cultivators, he must cover his cross-ditches, if he does not want to be annoyed greatly by reason of being obliged to turn his team and plough, whenever he comes to a cross ditch. This would not matter so much, however annoying, when giving the land the first ploughing, or "breaking it." But after he has planted his corn or tobacco in rows, from ditch to ditch, in turning his team while ploughing with a cultivator, he would necessarily have to tramp over young sprouts and ruin them. Therefore, in countries where they use ploughs, they cover the cross ditches, unless it be a very large one serving perhaps in lieu of a fence, or as a land mark between two estates. The easiest way to cover ditches in a country where timber is plentiful is, after the ditch has been dug *at least* two feet deep, and 15 inches in width, to lay two saplings of equal length, on top of each other on either side of the ditch, and place them there firmly by driving stakes in front, into the ground. This must be done continuously from one end of a ditch to the other. Then sticks must be cut of a length equal to the breadth of the ditch, and laid closely together, across the saplings. Next throw long grass, twigs, or large leaves, over the cross sticks and fill up the remainder of the ditch with the dug-out ground over all, stamping it down well. The surplus ground taken out previously will soon be levelled out by means of a plough and harrow. Such a ditch, if well made, will last for many years and prove excellent drainage.

Now that plants are very plenty, the largest portion of the Malyan Peninsula still undeveloped, and coolies in goodly numbers easily obtained at low wages, as well as very few planters familiar with a plough, I dare say very few would think of making covered cross ditches. But in a few years after an influx of many people in search of good lands therewith increasing the demand for labourers and the rates of wages, they will learn to plough, make covered ditches, &c., and profit greatly by it, and would now, if familiar with agriculture.

In conversation with several planters, at different times, from Deli, I endeavoured to convince them of the advantages gained in using ploughs and cultivators. But, no matter what I did or could say to them, they asserted their conviction that the great mass of roots, stumps &c., would render that sort of cultivation impossible, and they would not not try it as long as they were doing well by their mode of cultivation. As a good practical [illegible] as a "planter," who depend upon [illegible] of coolies for their success, who were brought up in large cities and mercantile houses and could not hitch a team to a plough, even if they wished, having no practical information about making a good Plantation out of a wilderness or about economizing in the right direction, a farmer could, of course, could not give them a clear insight. I admit that there are large trees, stumps, roots &c., *ad infinitum*; but for all that, with the machinery and implements of the present time at one's command, these hindrances can all be overcome and much easier than one, not familiar, can imagine. *Let it be remembered that a very large portion of the United States and Canada not so very long ago* was covered with an exceedingly heavy growth of timber, of both hard wood and pine, and that the early settlers had but, comparatively, very poor implements and tools to convert the huge wilderness into the broad and magnificent farms, cities, villages and hamlets that one meets to-day. It can be done here also, if a few practical planters "go ahead," and demonstrate to the untutored how it can be done.

The manner of cultivating corn.—In preparing the soil, it must be hoed or ploghed deep—*the deeper the better*; and the finer it is worked, the better; in order that the roots and tendrils, which on a matured stalk of corn are found to have grown therefrom, like rays, presenting the form of a bill or cone, can enter the ground, without meeting with hard obstructions or lumps; and, the cultivation, necessary after sprouting, is made much easier, doing much towards a vigorous development of the crop. After the ground has been ploughed or hoed, it should always be harrowed at least twice, both ways. Where the ground is still full of stumps and roots, a harrow of particular and peculiar make is required, that will not get fast among roots and creepers. A harrow of that sort, a great blessing to timbered and prairie countries they have now in the United States, and it is very simple and cheap and within reach of the small farmer. *It will stir soil, well, where no kind of plough, without previous grub bing could be used*. It has a simple strong cross frame, and is small and so arranged that several sections of equal size can be fastened to it, to make quick work on favourable soil. The tooth of this harrow is of peculiar make; it resembles a huge hunting knife, only shorter and much heavier, and having an edge rounded backwards from the middle to the point, instead of forward, as on a plough, is enabled, owing to the weight of the harrow to cut all the fine roots and lumps, and when an obstruction is too hard or large to cut, *it will slide over it* with perfect ease and without jerking the team, or getting fast where a plough would. This is a simple and powerful agent to assist the planter, and not one should be without it. One yoke of oxen, or a buffalo, of ordinary strength can pull it over most any kind of land. Tobacco land needs precisely the same preparation.

The land ready for cultivation must be marked by making light drills, running parallel, *four* feet apart. Drills can be drawn crossways *three* feet apart, and should be marked in that way, where the planter uses a cultivator after the sprouting of the crop. In a field however, where there are *many* stumps and roots, a cultivator cannot be well used, and, therefore, cross-drills need not be drawn. To mark the land in drills *four* feet apart only it should be staked off. The ground, thus marked, is ready for dropping the seed. The "hills" should be planted *three* feet apart in the drills throughout the whole field in a careful manner. The same rule should be observed in planting tobacco.—For each hill *four* kernels of corn should be dropped, and covered by a person following with a hoe, to a thickness of about one inch pressing the ground lightly after having covered the seed. The person counting off the three feet and dropping the seeds should not cover the latter nor be spoken to while doing the work properly, in order to be enabled to count the kernels regularly, and thereby insure the uniformity of the crop. I have listened to, and took part in many an argument as to the number of kernels that should be dropped to each hill, and experience has taught me that four kernels are better, than 3, 5 or 6, because in fours, each stalk will get the sun, and no matter from which quarter the wind blows, three stalks will give the one most exposed better support, preventing falling over than two stalks. If more than four kernels have been planted, then there is too much vegetation in one hill; some of the stalks are shaded too much and do not produce good ears, besides, a large bunch of stalks in one place will shade the neighbouring hills too much when once man high, and retard the maturing of the crop. The kernels when being planted should not be placed too closely together, but each kernel shoud be at least two inches from the next one.

Insects, birds, squirrels &c., will sometimes eat the corn right after being planted. A planter, should therefore, as soon as he finds that the crop has sprouted, to a heght of about two or three inches, follow every drill in the field, examine every hill, and, wherever he finds that less than four kernels to a hill have sprouted, he should replant the deficient number at once, as well as pull up all sprouts over four in a hill, where too many kernels had been dropped. That done, he should at once hoe and weed between the drills and hills, *no more than to loosen the ground at first, and not to draw the ground up to a hill*. When the crop has attained a height of from 8 to 10 inches, he should weed again and *then* draw the ground *from between the drills to within about 2½ inches of the sprout*, so as to form a cup shaped hollow all around the same. The hoeing and drawing up of the soil to the proximity of the plants, is done, firstly, to well cover the roots and give them strength, while the cup like hollow around the stalks catches the rain and dew drops that drip from the blades and stalks; and, secondly, to drain the field in case of hard rains.

The ground drawn from between two rows or drills of corn towards the hills tends to run off the water in case of freshets or long continued rains. This work should, however, never be done right after a rain, and not until the ground is dry and easy to work. This hoeing should be repeated least three times until the corn is about 18 inches high. After that and until the ears have formed, care must be taken to pull up the weeds and bunches of grass, especially such as are found close to the stalks. This is the "sine qua non" of securing a good crop; corn will never thrive in a weedy unclean field, no matter how good the soil. Our western farmers, any that are anxious to do well, watch this period of the growth of a corn crop from sprouts to knee high, with the greatest care; well knowing that if they fail to secure a good corn crop their stock must suffer; *the two, corn and live-stock, going hand in hand together. And what is true there, would in a large measure become true here, when and wherever a planter is anxious to have* good horses and cattle to help him in making a plantation *worth looking at* and to fatten plenty of swine, that will gladden the heart of his Chinese coolies; also enable him to have a goodly supply of nice roasting ears for his own table, as well as good wholesome corn bread and porridge. And than poultry! what nice poultry, tender, juicy and fat, people might have, if those that raise them would give them, even only occasionally, a good feed of corn, or corn meal stirred up with a little water or sour milk *free from salt* (the latter, meal-feeding, especially, to make the hens lay.) That's not all! People having milch-cows and goats, if they will gather daily, and promiscuously in a field, a lot of corn blades to feed to them, they would soon find an increase in the yield of milk and of far better quality, than the feeding of tough grass and "lallang" will produce. Horses and *mules* (*unfortunately* the planters, as a matter of exception in tropical countries have no mules in the Straits Settlements) receiving daily one good feed of corn blades together with a little salt will keep them in good order, sleek and fat. All grass-eating live stock will improve in every way, and, in such a climate as this, that knows no frost, the supply of green corn fodder can be constant, since within one month from the time of planting, stalks will grow about from 3 to 4 feet high, and can be fed whole. In several of the Southern States in America, where the planters clear their plantations out of heavy timber, and where every planter cultivates his soil, after it has been well grubbed with ploughs and cultivators, they keep a sufficient number of *mules* to do all the farm-work required. They seldom keep horses for that purpose and only for horseback and carriage riding. Meadows are seldom found on southern plantations; only on old estates, where they having generally plenty of land, allow well-worn tobacco and cotton lands to go fallow for a few years, and to serve as pasture during nights and on Sundays for their working stock and milch cows. Their chief dependence is *on corn* of which they raise large crops, and buy additionally from the Northern States besides, well as hay shipped in large bales from the prairie States down the Mississippi. Frosts occurring in nearly all the Southern States (Florida, Southern Louissiana and Southern Texas excepted) they raise but one crop of corn annually, the same as in the Northern States. Now, as soon as they (the Southern planters) find the corn crop has well advanced, that the ears are well formed and "in milk, ready to mature, they strip all the blades from the stalks and cut the latter off, about one third of their length and tie all, blades and tops of stalks, into small bundles or sheaves after having been well dried, and then feed the same in lieu of hay until they have another crop. Of course they feed corn in the ear or shelled at the same time, one feed in the morning, another at noon, and a third one in the evening, to all the mules and horses at work. To feed corn in the ear, while green, in milk, or not yet sufficiently hard, to deserve being called ripe, is called unsafe by many, because in that condition it has a tendency to give to stock, especially horses, the cholic. Now it happens sometimes that a planter has fed away all of his last year's corn, before a new crop is ripe, and then he is obliged to feed green corn. I have been thus obliged once or twice, in consequence of freshets that had injured my last crop; but I had not only no bad results from it, but my stock rather improved on it. I took, however, the precaution to feed plenty of salt with the corn, and I never had a sick horse, and I would not be afraid to repeat the same practice right here in this climate. As to fattening stocks whether oxen, swine and sheep, there is no feed better calculated to reach the desired end than corn stalks blades and green ears all cut up together and salt thrown over it; also, to feed matured corn in the ear shelled, or ground into meal; *meal feeding being by far the best*. Now with a climate and a great abundance of excellent, soil so favorable to the grow the corn, as we have hereabouts, what is to hinder a planter, to have plenty of corn, together with good crops of tobacco, sugar, rice, tapioca &c., and healthy well-fed livestock at the same time. But all that is not by far the greatest advantage derived from the cultivation of corn.

Most all experienced planters agree that in order to have good crops of most anything, one should change crops; and that is sometimes much easier said than done; but, in this climate, it can be solved easy enough by planting corn, in changing crops. Now, after having given an illustration of corn in as lucid a manner as I could, one should naturally come to the conclusion that such a cultivation, so frequent a stirring of soil, should not only loosen it considerably, but what is equally important, mix the subsoil with the topsoil. Such is the case. Let the planter hoe or plough the same soil after removing a crop, and he will find that he can penetrate deeper with greater ease, as wall as break the land fine. Let him then follow with crops of tobacco, sugarcane, cotton, tapioca &c., cultivate it as carefully as he did corn, and he is sure, unless severely visited by elements, to have a yield that will make him happy. After that let the land go fallow for a while and let the stock graze on it (grass is sure to follow) and then prepare it again for corn. After removing that crop, if the planter has plenty of manure, which he should always nure carefully, let him haul it on and spread it over the field; or, in the absence of manure, let him haul on the field old logs, stumps, roots and branches, pile the same in different places in the field, then burn it and spread the ashes well over the ground, and then break it. Rice I would only plant, if at all, on lands liable to overflow. If a person, unacquainted with agriculture and soil, engages in tobacco planting, and he is not sure, whether the soil is suitable or "the salt water too close," let him first plant a few hills of corn in different places, cultivate it well, and, if he obtains a good vigorous growth, *and no yellow blades*, he may rest assured the same grounds, *if properly prepared*, will produce good tobacco.

A planter, so called, in Sumatra, once told me that before going headlong into planting tobacco, not knowing whether the soil was sufficiently fertile to insure success, one of his neighbours shipped a box full of his soil to Penang, with a view to have it analyzed by a chemist. There being no chemist at the time at Penang, the patient box of "that soil" was shipped to Calcutta, where a chemist examined it, and pronounced it good fertile soil, fit for tobacco planting. The poor credulous planter invested a large sum of money and planted a large field of such soil. The small plants grew vigorously, until they attained a height of about ten inches, then they sickened and perished. Such good soil, too!—I asked him about the nature of top and subsoil. (Answer 1) about eight inches of rich black vegetable mould, (2) a small layer of sand, and (3) under it, a heavy stiff clay subsoil without sand (as above shown, speaking about bottom-land). Had the planter cross-ditched that land, giving the land time to become well drained, he would have had a good crop, no doubt; but, had he planted a few hills of corn first, he would have found out, what was wrong about the land. The chemist in Calcutta understood his business, "the planter" did not!

Harvesting.—In the United States two modes chiefly, for harvesting corn are observed, after the corn has matured perfectly and become hard and "flinty." The first mode is to cut the stalks a few inches above ground, then to gather the stalks from about 18 hills in one place, place them closely together in an upright position and to tie them together *firmly*, about five feet above ground, with twisted willows or other cheap tying material. This mode of harvesting is mostly observed by farmers, who during the winter keep their stock in stables or enclosures, with a view of fattening them for the market. In feeding, they lay the dry stalks, with the ears on them before the cattle; and they also pull daily a sufficient quantity of ears from the stalks to feed to horses in feed-boxes, and also to feed swine and sheep, while the stalks are feed to young cattle and milch cows, because they contribute better to a good yield of milk than hay. I look upon this mode of harvesting as very economical and useful, while it costs more than the other mode I am about to relate; and is generally practised by the wealthier class of farmers, who have plenty of help at their command. Many of them feed little or no corn in the ear or shelled; but have corn mills on the spot and grind, some of them the whole ear with the cob, into meal, and others only shelled corn. Meal feeding is in every respect the best, and most advantageous.

The other mode is, in autumn, after all breaking of land and seeding of winter wheat is over, to drive into a cornfield with a wagon, beginning with an outer row, and to break off the ears, strip them from the husks (or paper like skins) that cover the ear; throw the now bare-ears into the wagon, and to discharge the contents of the latter into a corncrib; and to continue in this manner until all the corn has been taken out of the field. The fence of the latter is then opened, and all the stock on the farm, horses, cattle, sheep and swine, are driven into the field, to help themselves to the now dry blades, husks and stalks; the swine eating the stray ears of corn that have been overlooked while gathering the crop, or what may have been wasted, while husking. In fact, sometimes, a stock farmer, or drover, will buy from a poor farmer a small field of corn of from 10 to 12 acres or part of a field not yet harvested, pay him so much per acre, and then drive in a large drove of swine, which he is anxious to fatten in as short a time as possible, and they will make short work of it and get fat in a very short time. After the swine have eaten all the ears they are taken out, to give way to horses, cattle and sheep to pasture off the blades and thin ends of the stalks. Corncribs are generally built of fence rails or saplings laid on top of each other, so as to form a hollow square, and are carried up to a height of about 15 feet, a rough floor is put in about 18 inches above ground. Into this square the husked corn is emptied from the wagons coming from the field; as many corncribs are built as are required to receive the whole crop of corn; a crib built in that way has the advantage of affording the corn, which like all cereals, when fresh and piled up, will heat, the necessary evaporation.

Now, the two modes of harvesting and securing a crop above illustrated barring the fatening of swine in a corn field &c., will answer well enough in a country with a regular cold season and frost, and above all, with a dry atmosphere. In this region of country, with its tropical climate, and atmosphere greatly charged with humidity, and frequent gushing rains, the said modes would *never* answer. Stacks in a field, no matter how well bound, would become musty and the ears would rot, and, if thrown, with or without husks, into a crib, the same result would be certain to follow, not to mention the swarms of insects cribbed corn would attract.

About three years ago I asked a friend in America to send to me a few species of corn, to see how they would do here, and he sent them. I was living in the hotel at the time, and having no garden of my own, I gave seeds to different friends and other persons, with the request, to let me have an ear or two in case of success. The seed received I had in a closed cigar box, with the exception of three or four huge ears of so called "Dentcorn," which I had lying on a table to show to people calling on me. One day I found that all the exposed ears on the table had been attacked in different places by insects in a very peculiar manner *i.e.*, they bored small holes, as if made by a coarse needle, between the flat sides of the kernels, inwardly, to the point or germ which is the most tender part of the kernels. I lost no time in examining the seeds in the cigar box and found that not a single kernel was injured. I sent at the time when dividing the seeds a quantity of different species to the Honorable J. Douglas, Colonial Secretary, together with a short treatise upon the cultivation of corn; for the benefit of the Malay States or planters hereabout, but he never informed me of any success obtained anywhere.

Of seeds issued to friends here the Honorable Mr. Whampoa sent to me few ears, which were finer and larger than any I received from other persons. I hung up some of the ears sent to me by him and others without removing the husks, and put those sent without husks in my seed box I examined the husked ears from time to time, and found that the insects did attack them *and I am now very glad I made that observation*.

The *preservation*, therefore, of the corn, after having been harvested, is the most difficult task in this whole matter; and I have thought and reflected a great deal upon the subject, and my recommendation as to the procedure for the preservation here, not being based upon experience gained in America, is a very humble one. I would thank any one that will try it greatly for any information as to the results of the mode recommended by me.

For seed, the very largest and best developed ears in a quantity exceeding the actual demands by at least 50 per cent.(in case of some mishap to be able to renew the planting), should be selected by the planter, if he knows more than his coolies, himself. To preserve them I would recommend that, either, they be hung up in a kitchen about five or 6 feet above the fires, *in the smoke*, that they get a thoroughly good smoking without becoming scorched, or, that the planter give each ear a coat *of coal tar*, or *kerosine oil* which will never injure it, and then hang it up in a *loft* or *drying* house.

In America, in places where squirrels, birds or insects eat the kernel planted, people often moisten the kernels (shelled corn), placed in a vessel with kerosine oil or coal-tar, planting them immediately, and this has proved a reliable preventative. I think a coat, of coal tar *over an entire ear* is the best preventative.

To preserve corn, with a view to have it ground into meal or to feed to stock and poultry, I would recommend the following.

Be sure and harvest your corn during fine bright weather, break the ears off, but do not pull back the husks, nor pull them off entirely. Spread these ears out in a sunny place and turn them frequently, in order to make certain that the corn is hard and *quite dry*; and, as soon as dry, bring them into the house at once, and don't leave them out during the night. I would then put the ears in baskets of coarse loose weaving, such as are very common here in the markets and bazars to hold fruit, potatoes or poultry, &c., generally made of split bamboo, in the making of which Malays and Chinamen are great adepts. The baskets, after being filled, each containing about a half a picul, *or less* I would hang them up consecutively, on poles, in a dry-house that can be closed during damp rainy weather. During and immediately after rainy weather, I would put a pan or pot containing burning charcoal on the floor, under the suspended baskets of corn. Different tires of suspended baskets could be made. Precaution must be taken that the roof of a dry-house is quite tight—will let no water through. Such a proceeding, it strikes me, will go far towards preserving corn in the ear, and is very simple and cheap.

What will become of the corn stalks, after the corn has been harvested, some might ask. I would drive *all* my stock into the field, and let them have plenty. Hereabouts corn stalks will remain green for a long time and have a tendency of making new shoots after the removal of the ears. Let the cattle eat all up clean except the lower half of the stalks, which can be cut off thrown into heaps and burned, or hoed into the ground. Corn stalks, also, tied together in continuation like a mat, will make very good thatching for a *roof*; as I believe much better than attap or lallang.

What else can be planted in a cornfield.—When a crop of corn is fully and safely developed, the stalks having obtained a height of about four feet, the planter can plant near the base of a hill of corn beans, squashes, melons &c., in different parts of the field; only not too closely together, which would have a tendency to stunt the crop. This, however, would never do during the early cultivation of corn after sprouting, as above mentioned, because it would check the growth of the crop, and the vines and creepers would be in the farmer's way, while hoeing a field. Nearly every farmer does this in America, with useful results. I have often seen them in autumn hauling out of corn-fields wagon loads of fine large pumpkins and squashes; which in addition to being acceptable to man for his own use, make prime feed for all kinds of stock, horses excepted. That certain species of beans, and squashes grow well in this region is so well known a fact that I need not say any more upon the subject. It is worth trying.

The planting of trees.—When people set out from the young sprouts of trees in this tropical region, they generally fix in some way a cover over them to shelter the young tender shoots against the fierce rays of the sun and to ensure a vigorous growth. Now let any one, after a crop of corn has attained an average height of about four feet *and is a regular even crop*, plant the young sprouts between the drills. The corn stalks, four to a hill, with their large blades, I firmly believe, will give the shoots all the shade they require and let in enough of sunshine as well. By the time the corn has grown to full height and been removed the young tree will have taken root firmly, which is the most essential to ensure its growth. Another advantage gained in doing this is that the ground is already marked for the setting out of young trees at regular distances and right angles. If the trees, for instance, should be planted 24 feet apart each way, all the planter has to do beginning at a desired point, would be to count off six drills, place his stake between the sixth and seventh row, and then measure off in the row 24 feet and place the second stake, and so on. As a matter of course it would not do to drive the stalk into such a field, to feed on blades and stalks, for they would tramp down the young trees and eat the shoots. No, in such a case I would cut the stalks with corn and all in the field, and cart them to the stock enclosures, there break off and secure the ears, and use the stalks and blades in the most enconomical manner I could, agreeably with circumstance.

Fences and Hedges.—Many a planter, not a practical agriculturist but knowing much about the country in which he plants, after having read, or been told of the foregoing, will naturally say: that's all very well, but what are we going to do to keep out wild pigs, elephants, bears, deer and other sweet toothed animals fond of sweet corn stalks and blades, and what will keep out the carnivorous wild beasts, as the tigers, leopards, panthers, &c. that will devour the planter's live stock pasturing in a field.

Such are reasonable questions; but they can be answered, with the exception as regards a few dangerous animals that can climb or creep. In every country some destructive animals are found, huge, middle sized and tiny; aye, so small that they can only be seen with a microscope, doing unmeasure damages, not to mention the visitations of Providence through the elements, swarms of locusts, caterpillers and cattle-plagues &c. *ad infinitum*. All this not to talk of the misfortune that may befall man in any and every sphere of life, the planter must expect; and he that is wise and economical, earnest to be successful, will provide, as best he can, such means as will prevent loss in any shape.

Look at the Western pioneer, frugal, simple, earnest, industrious and sinewy, who cannot go and hire a hundred coolies to do his bidding, and must depend on his practical personal experience, gained in the school of hardships, his brawny arms and an all kind and omnipresent Providence. He arrives on his new claim in the wilderness, whether timber or prairie, with his covered wagon, drawn by oxen, or horses, or mules, a cow or two perhaps some young stock, following; with all his worldly effects, such as a few simple household articles, a cooking stove, a few farming implements his trusty rifle, some seeds, axes and a few most needed carpenter's tools He overlooks his future home and field of usefulness, selects a place for a house, generally near a creek or a good spring His quiet survey made he takes off his coat and goes to work. First he cuts down a few good straight trees and hews them for his log cabin prepares rude flooring, by splitting logs, also his joist and rafters out, of saplings. There are not always people in the neighbourhood to help him in the "*house-raising*"; if not, he helps himself, his family assisting, him as best they can, He is hardy and strong, knows purchase and lever power, If new settlers live within a few miles, he calls upon them to come and help him put up his log cabin, and they respond quickly. There is a mutual understanding between them that is golden! Next he goes to work clearing; he is a fine axe man, and in a remarkably short time he has cleared a few acres and burnt over. His family with grabbing hoes and practical information, plant hurriedly, between the stumps and roots, corn squashes, pumpkins, melons and vegetables. On the success of this first little crop, if he has no wealth or ready cash, depends whether he can remain on his claim or not, and they watch it carefully, for there are destructive animals all around them. Hence while the family plants the new clearing, the head thereof prepares an enclosure for the preservation of his stock—a stockade or high rail fence well staked and secured; and cuts and splits material for a fence around his clearing hauls it and sets it up and well too—all in an astonishingly short time. The foundation for his wild pioneer home is now laid! He does not stop there, while his first little crop is growing, minded by his family, he continues to clear land or plough up prairie sod. He looks about him for hay or fodder to seed his stock through the winter. He goes and helps his neighbours chopping, ploughing, harvesting, thrashing &c., and they must help him in turn, a day for a day &c. He works hard, faithfully six days in a week and rests on the seventh with all his family. Weather permitting they go "to meeting" in some distant log school house, meets his neighbours, exchanges friendly greetings and talks about the prospects of the crop and weather, and the like. And so he plods along! Go and see that place in a year from the time the pioneer arrived on his soil, and one will hardly recognize it any more. His log cabin has been made comely and comfortable; additions have been erected for holding and preserving his products. There is a garden nicely and neatly fenced in with gates, all by the pioneer. There are good substantial log stable corncribs, enclosures for the working animals kept at home, and, instead of last year's small clearing one will find a well and substantially fenced field of from 15 to 20 acres, and the family hard at work in it planting corn &c.

Fences. Every planter needs one, and nowhere more than in the prairie States, where timber is generally scarce and expensive; where people mark or brand their stock and let them roam at will over timber and prairie, to find their own living, and where one must have a lawful fence as prescribed by law, before one can sue for the damages done to his crops by a neighbour's cattle, that will break occasionally through neglected or rotten fences. Many prairie farmers have resorted to hedges, generally of prickly and very bushy shrubs, that will attain a height of seven feet or over; but, before they can have a hedge they must first build a fence and plant the hedge under its protection. That a good uniform hedge is better than a fence in several respects, no one need doubt.

What kind of a fence or hedge is best hereabouts, to be effective against destructive animals, such as I have mentioned above? This region, as is well known, is a densely wooded country, and one but has to help himself to make a good strong fence. It would be almost useless to describe minutely the making of a so called "American rail or corn fence"; because that must be practically learned and understood, before it can be carried out; but if there is a planter on the peninsula of Malacca, or in Sumatra, that knows how to build and will build one, it will well pay every planter to travel a long distance, to go and see and learn how to imitate it. Better wood for fencing, very hard and growing straight as an arrow can no where be found. A *stockade fence*, well braced and supported, is very good indeed, but requires much time, labor and expense; and when, as it will happen some times, it is in one's way, and must be removed, it is very time absorbing and expensive to set it up in a new place; but it is better to do that than to have no fence at all. For enclosing a planter's house in or near the jungle, his cattle folds or stables &c. a substantial well and wisely put up stockade fence is the best, especially when large ditches are drawn all round the stockade. For a field, the best, cheapest, strongest and most practical fence is one that is easily and quickly made in the beginning, can be moved at any time and set up in another place, without much loss of time and expense, and that is the "American fence," if one will imitate it as nearly as possible. In making one here where timber is so plentiful, no one need go to the trouble of splitting rails. In clearing a field let all the saplings of about 20 feet in length from root to fork, be placed together in piles of about 12 or 13, in a continuous line around the whole square cleared, close to where a fence is to be built. After the burning of the clearing let a detail of picked strong coolies be made to set the fence up, while the rest go to work in the field. Let the saplings be laid on top of each other, 12 or 13 to one pannel, in zig-zag fashion along the whole line or edge of the field, to a height of about 12 feet, which neither deer nor tiger as a rule will jump. Where, in laying the saplings up, the end of one crosses the other, the lower one should be notched or grooved across, which will firmly imbed the one that comes to lay there. This should be done from bottom to top, on the same principle as building a log-house. In commencing to "lay up," a small chunk of wood or a flat stone should be laid under the lowermost sapling (under both ends) so that it will lay a very few inches, 3 or 4, above ground and rain water. The few uppermost saplings might be fastened or bound together in the corners, where they cross each other, with rattans, or tough strips of bark, so that they cannot be rolled off by elephants, or give way on being pushed. The work of laying such a fence must be prosecuted along one line and two corners at one and the same time, and if it can be done along the whole four all the better. Such a fence finished, it will shortly settle to the firmness of a brickwall—*it will stay there,* until one wishes to move it to another line, in which case all one has to do is to take down the saplings and cart them to the new line. If it is found that a height of 12 feet is insufficient or too high, the change can be made easily, by increasing or decreasing the number of saplings alike in every pannel. In moving such a fence and setting it up again those saplings that had been before lowermost, should be laid uppermost and the late uppermost, now lowermost. They can be preserved longer in that way. Precaution must be taken to hoe the ground, inside and outside, close up to the fence, and in the fence corners to keep vegetation down, which will, prevent the rotting of the rails as well, as keep snakes out of fence corners, which are as plenty and venomous in America as they are in this country. Outside the fence it is well to cut down the jungle for a breadth of about three rods all around the fence, to prevent its being shaded and rooted so much faster. Hedges I would only plant along a road or in places where one is planted with the intention of setting it as a permanent barrier, and would recomend sapanwood for the purpose, which is very prickly and of rapid growth. The seeds should be planted about 9 or 10 inches apart, and when about five feet high the tops should be cut, to make it grow bushy, interwoven, and to give it body. I would then let it rise to about 9 or 10 feet, and top it again; thereafter keeping it at that height as nearly as possible. It should be planted inside of a fence, to give it an unhindered vigorous growth and the fence should not be removed before the hedge has grown strong enough to be self-sustaining fully. In planting a sapanwood hedge one has the satisfaction to know that whenever he must cut down the hedge he can readily sell the wood at fair figures.—The "[illegible]" tree, a very hard and prickly wood, would in my opinion also answer well for a hedge. It grows very bushy and being so very prickly, hardly any animals want to go near it. It would be both useful and ornamental. It bears a fruit, resembling a small apple generally used for preserves and much liked by some people.

A. G. STUDER.

Singapore, September 1878.

NAGPORE EXPERIMENTAL FARMS.

FROM J. W. Neill, Esq., Officiating Commissioner, Nagpore Division, to the Secretary to the Chief Commissioner, Central Provinces, dated Nagpore, the 2nd August 1878.

SIR,—I have the honor to send you Major Macdougall's report on the management of the Model Farm for the past year, to which is appended a memorandum by Mr. Barclay, who held charge for part of the year, drawn up in January last when he was relieved by Major Macdougall; and I shall now, following the order of subjects observed in the report, make a few remarks on what seem to be the more important points.

Rain-fall.

2. Major Macdougall first discusses the rain-fall, which was abundant or rather superabundant. Before the end of June the monsoon had brought 8 inches of rain; in July 15, and in August 10 inches fell; September contributed nearly 6 inches, and October not much less, and again in December there was an inch and a half of rain. But this abundant rain-fall was by no means altogether favourable. The early monsoon falls facilitated the preparation of the land for the kharif. The sowings were completed in good time, and the young crops showed well above ground in July; but thereafter the heavy rain did harm, and the latter monsoon sowings were delayed and were got in under less favourable circumstances. In September time was given to prepare the land for the rabi and to hoe the kharif crops, but October was much wetter than usual. The early rabi crops which had been put down suffered severely; fields had to be re-sown and therefore late sown. The cotton and jowaree also suffered; and although during November, a dry month, hopes were entertained that fair crops would be secured, the rain in December falsified these hopes. The cotton which had reached the stage of a second picking was much injured, and the jowari was infected with smut. The same rain ruined the linseed and vetch crops. There remained the later rabi crops. The wheat was late and promised fairly but rain again brought rust and did enormous damage. Thus the season, which at first gave every promise, proved on the whole far from favourable, and from an agricultural point of view the year was far from a good one. Throughout Nagpore and the neighbouring district of Wardha things were much as has been described. Jowari, however, generally yielded a fair crop, and but for that it is believed that there would have been considerable distress. The cotton crop too was a fair one. It had promised to be excellent, but the rain injured the quality. Wheat and linseed and gram were a great failure however; whole fields of linseed were allowed by ryots to remain untouched. Wheat yielded a wretched [illegible], and the grain was shrunken and withered in appearance; gram there [illegible] in the country.

The farm lands therefore merely suffered in common with the surrounding country.

Condition of soil.

3. Major Macdougal next turns to the condition of the soil, and explains that the labour expended on the land during the last four or five years has greatly improved it. The deep cultivation, he says, has had the effect of mechanically changing the nature of the soil. There can be no question, I think, that the soil of the farm has been much improved. Indeed it would be strange if it were otherwise, when fields have been levelled and manured, and the greater part of the farm has been deep ploughed. Major Macdougall remarks that Mr. Barclay in his memorandum doubts the efficacy of deep ploughing, and comments on the subject, but I do not understand Mr. Barclay to entertain such a doubt; what he appears to me to say is, that the land cannot be enriched by deep ploughing only, and that something more is required, *viz.* manure,—an opinion which seems hardly to differ from that entertained by Major Macdougall himself, who in the same passage says:—"what we have now to devote attention to, is the increasing the fertile powers of the land. This can only be done by the aid of manure."

Manure.

4. While in charge of the farm, Mr. Barclay tried the plan of carting fresh manure directly to the farm and, depositing it in furrows which were at once closed over it, the amount applied to each acre being 12 or 13 tons. The number of furrows per acre was 50, the furrows being about 5 feet apart. Some 10 acres of land were treated in that way. Major Macdougall objects to this, asserting that, inasmuch as there are 280 furrows and upwards in an acre when fully turned over, only 2 acres in all were manured; that, as shown in the 6th paragraph of his last year's report, the system adopted was extravagantly wasteful; that 355 tons of manure were actually left in a cake where the manure had been deposited; and that if the direct application of fresh manure was the cheapest method, it would certainly be adopted in Europe or America. Whether 2 acres or 10 were manured, would, I should say, altogether depend upon whether by cross ploughing the manure deposited in the furrows which were 5 feet apart could be made to mingle with and affect the soil between the actual furrows: how 355 tons of manure could be left in a cake on the land, if 180 tons in all had been brought to it, I cannot in any way understand; and I have turned

to paragraph 6 of last year's report, without being able to see that the direct application of fresh manure is proved to be a most extravagantly wasteful process. I perceive, however, that 10 tons of manure per acre is what Major Macdougall thinks is necessary, and I think he is right in this. I see also that he calculates that, if fresh manure be directly applied, 177½ tons of dry poudrette per acre is used, but this result is only obtained by his *assuming* that little less than a ton of fresh manure is deposited on every 12 square yards of land. Supposing less is applied the whole calculation fails and instead of its having been proved that the application of green manure is an extravagantly wasteful process, it has only been proved that *if* you apply so much per square yard you will apply so much per acre, which of course nobody can deny, so long as the rule of three sum is properly worked out. Whether or not green manure should be applied to the land at once, or only after it has been pitted and has got dry, is another matter; but so far as the mere cost of getting the manure and carting it is concerned, there can I think be no question at all that it is much less costly to take it at once to the land, than to take it first to the pits, then to unload the cart, to fill the pits, to keep an establishment at the pits, then when the manure is wanted, to dig it up, to fill the carts and to carry the manure to the land. To state the case seems to me to prove it.

The fact that fresh manure is not at once taken to the land in Europe or America may or may not be relevant. It is irrelevant if the reason is connected with the cost of procuring the manure and conveying it to the land, for the circumstances are wholly dissimilar. Here the entire cost is the cost of carriage; the manure costs nothing. It is relevant if the reason is that fresh manure is considered injurious to the crops, and yet it is not on this that Major Macdougall based his objection. To my mind the question whether fresh manure should be at once carted to the land, or first stored in pits and only applied after a time, depends upon whether the fresh manure would be too stimulating, unless the land to which it is applied could be allowed to remain fallow longer than the circumstances of the farm will permit. This is, however, a matter which has not been discussed, and I shall not attempt to discuss it on this occasion.

5. Altogether some 14 acres were manured in addition to the 10 acres treated with fresh manure, and the land has been devoted to experiments. Major Macdougall refers also in paragraph 5 to the excellent effect of the lime applied to a field in which sugarcane was grown. Stable manure was also used so far as it was available.

Roads.

6. In paragraph 6 reference is made to the improvement made in the road leading to the farm steading. I think the work was a useful one, and more roads are, I think, required. I quite agree with Major Macdougall, however, that the roads need not be constructed merely to permit of manure being carted to distant parts of the farm during the monsoon; what he says on that subject seems to me undeniable, still I consider that there should be roads to permit of the fields being approached during the wet months without men and cattle traversing the saturated fields.

Manure supply.

7. My predecessor last year referred to the supply of manure which would be required for the farm, and considered it necessary that measures should be taken to obtain an increase. The Chief Commissioner recommended the subject to me on my taking over charge of the Division, and looking into the matter I could not see that there was any difficulty in obtaining for the model farm as large a supply as it pleased to take. The real fact was that the farm could not afford to take more. Major Macdougall says that matters were allowed to remain in abeyance till about February; such was not the case. I had discussed the matter with Mr Barclay long before that, and he was quite aware that he could have any amount of night soil for the taking, but he saw clearly what Major Macdougall afterwards discovered for himself "that the expense to be incurred by the farm in supplying extra cattle for haulage would hardly compensate" the farm; and Major Macdougall further admits that the farm even now does not take all the latrine and dry rubbish manure offered to it. It is evident from this that the cry in former years for more manure was a misleading one. Plenty of manure was to be had. What the farm wanted, was the manure delivered on the spot free of charge; in other words, some one else was to pay for the carriage of the manure to the farm.

It is now recognised that the farm cannot afford to take more manure at the present cost of carriage, and it is accordingly proposed by Major Macdougall that the manure be applied only to the lands lying nearest to the southern road which now constitute the experimental farm; and that the fodder crops be grown also on this area instead of on the lands to the west, which are the most distant part of the farm, and to which manure could not be carted except at considerable expense. His proposal in fact amounts to an abandonment of part of the farm land as a farm. Some 10 acres of the experimental farm land would be devoted to the growing of the fodder crops, and on the formerly manured land of the fodder farm orange trees would be planted. The proposal is justified on the grounds that 10 acres devoted to fodder crops is sufficient; that these 10 acres can be made available on the 77 acres of experimental farm lands; that by concentrating the work there will be a saving of labour in supervision; that there has always been a difficulty in obtaining a sufficient flow of water to irrigate the fodder farm to the west and the experimental plots in the east, while the flow cannot be increased; and that unless a much higher value can be obtained for the outturn of the farm, the attempt at commercial farming will not succeed, for, Major Macdougall explains high prices for farm produce in India are generally indicative of bad seasons, and normal prices will not pay the expenses of such farming as is practised at the model farm. The Indian public will not buy first class grain at a reasonable price. "What native," he writes, "would in an ordinary year, when crops were well up to the average, think of paying for wheat such as was grown in the farm in the cold season of 1876-77, the prices that it was reported were capable of being realized in Bombay?" "Therefore," he concludes," the time has come for us to consider how far we are justified in having recourse to permanent crops likely to yield us large returns at a comparatively low cost." I cannot say that I share in these opinions. It appears to me that the object of the farm is not to clear expenses, nor yet to make a profit, but to show what new crops can be introduced, and how established crops can be better grown. I do not expect that a large profit is likely to be obtained from even the commercial portion of the farm. It is extremely difficult to apportion expenditure among different fields, and over different operations, and the main thing is, I think, to produce good crops, superior to those a ryot can produce.

Nor do I take Major Macdougall's view, that natives will not purchase superior qualities of grain at higher prices than inferior ones. If an export trade in any staple is established, natives will buy up the quality in demand for export, and native cultivators will *if they* are shown how, respond to the demand for the superior quality. If it is admitted that they will not, it seems to me that the establishment of model farms is a mistake altogether. If the ryots *will* not change their agricultural ways under any circumstances all efforts to induce them to do so are thrown away. Returning, however, to the main question,—shall the area of the farm lands be reduced in the manner proposed. I should not recommend it merely because of the difficulty in manuring the distant parts of the farm, nor yet merely because a smaller portion of the farm can be irrigated than was at first hoped. The supervision question is a more important matter. If the farm is too large for the farm establishment, then clearly it should be reduced in size, but I do not think that so much is said. What perhaps might meet the difficulties mentioned, would be a re-apportionment of the farm lands. The fodder farm might be brought closer to the experimental portion, the commercial farm pushed further to the west. Some means may yet be devised for cheapening the carriage of manure to the more distant part of the land. If pits must be kept up, why should not some pits be opened nearer the western boundary of the farm, and why should not the men employed at the pits be utilized generally on the farm. Improving the roads will also facilitate the carriage, and thus I return to this, that if the farm is not too large, there is not much to be said in favour of reducing it. Orange groves would doubtless prove profitable, but this proves too much, for if profit is the *desideratum*, the larger the area devoted to orange groves the better.

Commercial farm.

8. In paragraphs 10-12 Major Macdougall gives the general results of the cultivation of the experimental fodder and commercial farms. I need not follow him in his general remarks, and I pass on to paragraph 13 which gives the out-turn of crops on the commercial farm.

Cotton.

Two fields under cotton yielded 47 and 77lbs. of clean cotton per acre respectively. In the case of the larger out-turn the field had been manured three years before, and the yield of clean cotton was nearly 32 per cent. of the total yield of cotton and seed together.

In the case of the other field the proportion of cleaned cotton did not exceed 29 per cent.

Jowari.

Jowari turned out badly. There were some 80 acres under this crop, and the yield is said to have varied from "60lbs. per acre in field No. 21, to 164 lbs. in field No. 34. Even the best yield of the year falls short of the worst yield of the previous year, which was 232lbs. per acre." These figures do not appear to be quite accurate, for from the tables appended to the report, it would seem that this year jowari in field No. 15 yielded 205 lbs. per acre.

There can be no doubt, however, that the out-turn of jowari was much poorer than in the preceding year, although still superior to what it was in 1875-76.

Tur.

Tur was grown on some 80 acres; yielding from 239 lbs. to 419 lbs. per acre.

Til and Castor were, owing to the unfavourable season, failures.

Linseed. Wheat.

The out-turn of linseed varied between 60 and 225 lbs. per acre. The greatest out-turn of wheat did not exceed 107lbs. per acre; and gram was a total failure.

Major Macdougall has wisely indented on the *Director of Agriculture* North-Western Provinces, for wheat to be used as seed, all the wheat in these Provinces having been affected with rust.

Experimental farm.

9. An acre sown with Hinganghat cotton yielded 204 lbs. clean cootton, a result which, if good, does not approach those previously achieved. The proportion of clean cotton to cotton and seed together was 26 per cent. and Major Macdougall draws from this fact the inference that the cultivation was not attended to. I am not sure, however, that the inference is a fair one, seeing that the proportion of seed to clean cotton in this acre, is greater than it was on either of the fields in the commercial farm, where it is almost certain that the cultivation was less careful; and it has already been shown in the case of the two fields of the commercial farm, that

although the yield of clean cotton per acre differed considerably, the proportion of clean cotton to seed differed to but a slight extent.

Ginger,

The experiment with ginger appears to have turned out successfully.

The experiments with rabi crops were not altogether successful. Major Macdougall first refers to some tried in field 9 which had been manured with fresh manure, and which apparently failed; but he is mistaken as to the object of this experiment, which, it will be seen from Mr. Barclay's memorandum, and which he has also explained to me, was merely intended to test the effect of sowings on land manured with green manure the same year. He therefore tried various kinds of seeds on a small area. The sowings were, he explains in this memo., too close, which might tell against the plants later on; as an experiment, I should say it has proved wholly inconclusive, because it was misunderstood, and because the year was generally unfavourable to all the seeds sown.

On another experiment too, made by Mr. Barclay to obtain a cross wheat, Major Macdougall has some remarks in the same paragraph. As I understand him, he says there can be no natural cross fertilization between two different kinds of wheat; my knowledge of the subject is so slight that I cannot venture to say whether he is right or wrong. Competent botanists must decide; at the same time I must admit that passages in various scientific works appear to me susceptible of no other construction than that natural fecundation from other varieties is possible in the case of wheat.

The most interesting experiment of the year was with sugar-cane; 6 acres were under the crop richly manured, and 2 acres had been treated with lime at the rate of 3 tons to an acre. There can be no question as to the luxuriance of the crop; and it was remarked that latrine manure was infinitely more stimulating than stable manure, both of which had been tried. The crop when ripe did not turn out so large as it promised, owing to the falling off of the canes. Major Macdougall's explanation of this is as follows:—"After the end of July, instead of expending a few rupees and buying "poles—ordinary bamboos—to support the west and northern borders of "the acre, strengthening them to withstand the force of the winds which "blew pretty strongly in August and September, and thereby sheltering "the interior of the plot,—the crop was left to take its chance. The consequence can be imagined; a fast growing succulent crop, left to the mercy "of the winds, soon yielded. The borders being blown down, the weight "of the outer-grown plants bore on the inner area, and by October the "whole crop was laid. The canes had by this time got a set, and from all "the upper and exposed eyes new shoots shot up. The crop was thus lost. "* * * The whole experiment has therefore been lost from neglect in "following a custom which every ryot adopts."

Now I cannot admit that the description by Major Macdougall is not overdrawn. Certainly when I saw the sugar-cane much later than October, I did not notice the devastation he describes. I thought it also only fair to Mr. Barclay to inquire of him whether the canes were left to themselves as described by Major Macdougall. I transcribe his reply:—

"When I first went to the farm at the end of July, I found an establishment of 3 or 4 men employed for propping up the canes that had fallen. "Major Macdougall himself had sent a supply of bamboos from the Maharaj "Bagh (of the great clump that had seeded and died), and the Native Superintendent explained to me that it would be necessary to keep up this "establishment all through till the canes were cut, and they were so kept "up all through so long as I was on the farm till January. The books will "show this, and they will show moreover that a large number of bamboos "and bakal tie were from time to time purchased to keep up the crop. As "fast as one patch of canes was put up another came down, and the cry was "continually for more bamboos and ties, which were supplied. The canes "grew thin and tall, and came down on their knees on the least provocation still, on the whole I may say that when I left the farm in January the sugar-cane field was in capital condition." When facts are disputed as in this case, it would seem best to keep one's judgment in suspense.

A number of plants of the Carob are ready to be planted out; and the mesquit bean will be tried, but Major Macdougall appears to think little of it, and to deprecate its cultivation, as also that of the ground-nut, which he thinks can be left to the ryots. Perhaps he is right in this, although it is impossible always to trust to cultivators spontaneously cultivating paying crops, and in the most paying way, or else where would be the use of model farms.

Fodder farm,

10. On the fodder farm guinea grass and lucerne have been cultivated with constant success. On the other hand, *sorghum saccharatum* ringhni (jowar and *symphytum asperrimum* have been recognised as unsuited to the soil and climate, and inferior in every way as fodder crops to the Guinea grass and lucerne, I think Major Macdougall is right in ceasing to cultivate them.

Cash Account.

11. Statement II. appended to the report and called the Cash Account shows the income (chiefly consisting of the Government grant) to have amounted to Rs. 16,713, the expenditure, on the other hand, to only Rs. 11,609. There was thus a balance of Rs. 5,103. I need not go through the various items of expenditure; but I notice as satisfactory the fact that the receipts of the farm by sale of produce reached Rs. 4,113,—a larger sum than in any previous year.

Estimates 1878-79.

12. The estimates for the year 1878-79 are shown in statement III. The income is set down at Rs. 6,605; the expenditure at Rs. 10,600; and Major Macdougall explains that while an additional expenditure of Rs. 2,200 will be incurred on superintendence, a smaller sum than is entered will be spent on the farm. It appears to me that the best plan will be to draw up a schedule of sanctioned establishment for the farm, and to add thereto the grant for working expenses. Salary bills and contingent bills would be passed according to sanction within these limits, an all receipts on account of the farm (sale or produce) would be credited to Government.

This would I think prevent confusion. The receipts being deducted from the expenditure would at once show the cost of the farm to Government in any year. A statement would be furnished with every report contrasting the estimate and actuals.

Conclusion.

13. On the point whether the management of the farm was on the whole satisfactory during the past year, it will be difficult to pronounce after reading the present report. The season was unfavourable and the farm lands underwent the same influences as the country in general; but in addition to that, it is asserted in the report, that there appears to have been "a want of method and control at the proper seasons," and that the lands have been allowed to get dirty. These assertions are not quite consistent with the praise bestowed on the native superintendent, whose advance in knowledge and practical skill is specially mentioned, unless indeed he was thwarted or misguided by Major Macdougall's *locum tenens*. They appear also for the first time in this report. I know that Mr. Barclay when in charge of the farm tried to do his best, and took much interest in all the duties. I do not think any mismanagement on his part has been proved, although it is clear from passages in the report, some of them also having been touched on in this letter, that his opinions on certain points differ from those of Major Macdougall. What is to be regretted is that the same officer should not have held charge of the farm throughout the year. In that case failure of any experiment or the poorer out-turn of any crop would not have been attributed to defective management. But neither from my saying this nor from anything that I have said, would I wish it implied that I undervalue Major Macdougall's services in the management of the farm. On the contrary, I believe that the Chief Commissioner could not at present command the services of a better officer as superintendent. When I venture to differ from him, it is not on purely technical points, on which his experience must far surpass mine, but on such matters only as any person with the facts before him might pronounce. His heart I know to be in his work, and if I sometimes consider him not quite just to others, I know this to be in itself a sign of earnestness of which an officer caring little for his work would be incapable.

SEWAGE IRRIGATION.

We have received at the hands of Mr. H. Vilmorin, the reporter, a copy of a very valuable report recently issued by a sub-committee appointed by the Prefect of the Seine to examine the results of horticultural operations resulting from the use of sewage waters—on the abundance and quality of the crops produced, and the rent paid for the irrigated lands, as well as the best mode of employing the sewage, and the processes of cultivation carried on on these irrigated lands.

Without following out minutely the reasoning and theoretical details advanced in this report, there are some important facts given which deserve to be cited, as proving the utility and importance of the application of this liquid manure, or sewage water, on the crops. The purifying the Seine has also become of importance by withdrawing the city drainage as much as possible.

Horticulture, it is well observed, is only one branch of agriculture, but it is a very distinct branch, and one which presents very marked characters, *viz.* 1. In the abundance of the products obtained, on a limited surface, 2. In the more delicate and valuable nature of these products, and 3. In the important sums it employs in capital and labour on small areas, and the high rent obtained for land. The essential and important conditions for producing abundant and remunerative crops on a given surface are, on the one hand, the facility of disposing of large quantities of manure easily assimilated, and, on the other hand, of watering as often as is necessary, for facilitating the absorption by the plants of the elements of fertility contained in the liquid manure. The irrigation by sewage water responds at once to both these requirements, and it is carried on under conditions of facility and economy, which are presented by no other combination, for not only is the water and the manure given at the same time, but the manure is transported and distributed without cost over all the surface, and in an equable thickness over the arable bed, but it reaches the roots in conditions of division most favourable for immediate assimilation. When we consider that the vicinity of a large town is an immense element of success, more especially for a species of culture, where the products from their delicate and perishable nature require to be quickly consumed, we can easily understand that the lands which can be readily watered by the sewage manure are speedily occupied by market gardeners. This is proved by the increasing extent of ground cultivated with vegetables in the plain of Genevilliers, which has risen in the last ten years from almost nothing to about 350 hectares. This culture necessarily differs from the system of market gardening properly so-called, which devotes itself to forcing plants, by employing large quantities of manure as a source of heat rather than as fertilizers. The culture of vegetables in the open field cannot be compared to this costly and careful system, but must necessarily be limited to vegetables grown in the open air, depending only on soil and sun and ordinary elements of success. It is therefore in the abundance of produce obtained that the profit must be looked for. Fortunately Pairs is a large and insatiable consumer of vegetables, and it will be very long before the supply will exceed the demand. The inquiries of the Commission, therefore, go to prove that the employment of sewage waters for vegetable culture is favourable —1. To the abundant yield; 2, to the quality of the products, and, 3, to the money returns to the grower.

The Commission appointed in 1874 by the Minister of Agriculture to reward the cultivators of the plain of Genevilliers, who had most largely and advantageously employed sewage waters, cited certain facts as to the yield which had been proved to them, and it may be stated that the report of that Commission was due to Mr. Hardy, the Director of the School of Horticulture and Gardening at Versailles.

Among the yields given per hectare were the following: Cabbages, 75,000 kilos; beet roots, 120,000; carrots, 50,000; and French beans, 15,000. These figures are far from representing the maximum yield which can be obtained from an hectare, for many of these crops only occupy the land a few months, and therefore afford opportunity for another crop during the year.

Other investigations made by the Commission gave the relative yield per hectare as follows:

Artichokes, 36,000 to 50,000, and even 80,000 heads; cauliflowers, 20,000 to 30,000 heads, weighing about 35,000 to 40,000 kilos; garlic, 37,000 kilos; carrots, 60,000 and 80,000 up to 132,000 kilos; celery, 100,000 kilos; cabbages, up to 140,000 kilos; onions, 60,000 to 80,000 kilos; leeks, 60,000 kilos; potatoes, 30,000 up to 40,000 kilos; pumpkins, 120,000 to 140,000 kilos; salsafy, 10,000 to 12,000 bundles, weighing about 25,000 kilos.

When we compare these yields with those obtained in the open fields without irrigation, we find a double, triple, and even a five-fold increase in favour of those irrigated by the sewage waters. Its employment enables the cultivator to obtain from almost sterile lands crops approaching those resulting from market gardens where water and manure are lavishly employed at great cost, and where large vegetables are not generally grown, being considered unremunerative. Not only are the yields from the application of this liquid sewage considerable, but the beauty of the products leaves nothing to be desired. This fact was well exemplified by the success obtained at the last exhibition of the Central Horticultural Society in October, 1877, when a gardener of Genevilliers, Mr. Rothberg, produced a collection of vegetables admired by every one, which carried off the first prize competed for by all the market gardeners of the department of the Seine. Experiments made on the culture of fruit trees and other seedlings by this species of irrigation appear to be generally favourable. Among industrial plants, those grown for perfume, &c., seem to succeed well by the application of the sewage waters at Genevilliers. The yield of mint is 40,000 to 50,000 kilos; in two cuttings of Absinthe (*Artensisia*) 110,000 to 120,000 kilos the hectare; and of Angelica, 28,000 kilos per hectare in the second year.

The quality of the products obtained by sewage irrigation is fully equal to what is raised in the neighbourhood of St. Denis and Aubervilliers, in the plain of Vertus, which is the principal centre of production of vegetables in the open field, and they fetch as much in the central markets.

The irrigation, it should be observed, must only be applied by channels to the roots of the plants—not to the plant to soil it. The engineering arrangements for the transmission and diffusion of the water are excellent and easily managed, as we had an opportunity of seeing on a visit of inspection, made with a deputation of the Horticultural Congress, on the morning of the 22nd August. Flowers, fruit, and vegetables over the entire plain were in full luxuriance.

Had space permitted we should like to have followed out the enquiry with which this report deals, more minutely and systematically. We however commend the pamphlet, most carefully prepared by so experienced an authority in horticulture as Mr. H. Vilmorin, to the careful perusal of all interested in the subject of purifying rivers by the agricultural use of sewage waters. The report is published by Gauthiers-Villars, Quai des Augustins, 55, Paris.—*Journal of Applied Science.*

PROPERTIES OF INDIAN SOIL.

It is out of the question that much of the soil of India can be in good physical order. Really well tilled fields are so scarce, that few have opportunities of noting by comparison how much the physical condition of the land influences its productiveness, and consequently, failures of crops are attributed to the seasons which may have been brought about by the operations of very different causes. There is an admirable paper in the report of the Superintendent of Government Farms for the year before last by Mr. Schiffmayer on the physical properties of the soil. He observes that it may be chemically analysed, and found to contain the necessary inorganic elements of plant food, and yet in reality be unfit to produce anything. The physical condition is unsuitable, and the mechanical operations which constitute tillage have to be gone through before a yield that is at all satisfactory can be obtained. Chemical action can only have play when there is a free circulation of air in the soil. Cultivable land, apart from its intimate composition, is an accumulation of fine dust, whose particles, invisible to the unaided eye, form its essential part; and this is mixed with grains of sand and pieces of rock. Organic matter, the result of decayed vegetation, occurs in the top layer, and gives rise to the difference between the surface and sub-soil. If the state of division of the whole mass is fine, the oxygen and nitrogen of the air are attracted. Sand absorbs less of these gases than clay, and a well tilled, and therefore pulverised soil, more than one that is only roughly ploughed. But if the soil, in addition to sand and clay, contain protoxide of iron, and decomposing vegetable substances, the absorption of oxygen is very great the mineral fragments are disintegrated, and the plant food is rendered soluble, and fit to be taken up by the roots. There are other reactions. The ammonia and the carbonic acid contained in small quantities in the atmosphere are attracted and condensed, the particles of the soil enter into other combinations, and, it is supposed, the former remain in the complex silicates which are produced.

It is very important that plants should be able to obtain a supply at their roots of atmospheric air. The plant is enabled to grow more rapidly and yield much more, when there is an unlimited amount of free oxygen in the soil. Land in India, however, undergoes a smothering treatment, as if air circulating in the depths was not necessary. Yet an experiment made by Stockhardt demonstrates how much a good crop depends upon a liberal supply of atmospheric air. He grew test plants oats and peas, in cylindrical glasses 2½ feet high and 5½ inches in diameter. In one, air could only reach the soil as it does in this country at the surface. The other was perforated below, which corresponds to land deeply cultivated, thoroughly turned over, and well drained. The outturn in dry plant substance from the first glass was 90·8 grains against 161·8 grains from the second, or not far from a proportion of a half to one. It seems that the circulation of atmospheric air in the soil promotes the development of the roots of plants in a special manner. Schumacher found that in the case of barley the difference between restriction and access of air was as one to three in the weight of roots produced, so that the crop being much greater above with an increased ramification of rootlets, foraging in the ground underneath is not surprising. Besides this, the more valuable the species of a plant, the more as a rule the need of oxygen in the soil for respiration. It is, in fact, impossible for the higher types of plants to thrive, as long as they have only a limited supply of the atmospheric air so essential to their growth. It has been ascertained that the lower the temperature of a soil the greater is the absorption that takes place, and to this circumstance chiefly is attributed the beneficial effects that a low temperature produces on the soil, a point with which every practical farmer in Europe is familiar. But the soil, besides the mere air, absorbs largely the vapour of water, which the atmosphere is never without. Clay attracts 6 per cent. of its weight, and humus, in the form of peat, 24 per cent. of moisture. A sandy soil, however, containing much decaying vegetable matter, absorbed 70 per cent. of its weight, though after this had been burnt out only 0·12 per cent. Thus is illustrated the importance of having cultivated land in hot climates well charged with organic matter. In India particularly, this is a feature of agricultural practice upon which the greatest stress has to be imposed.

Mr. Schiffmayer affirms that a soil having much organic matter may, when properly tilled, in many instances receive all the water required for the production of crops by air irrigation, that is to say, the atmospheric air circulating freely in the soil can supply all the water needed by the plants. It is true that in hot weather the soil will absorb a larger quantity of moisture during the night, than the day; yet the great change in temperature during the day and night, observable generally in hot climates, is most favorable to absorption, since by the sinking of the temperature of the soil during the night, the watery vapour enveloping the particles of soil is condensed to liquid water, the formation of dew takes place, which penetrates the earth, and the soil is hereby enabled to absorb and condense watery vapour continually; so that although the alteration of watery vapour in a hot climate is less than in a cold one, the total amount of absorption may be much greater in the former than in the latter. The deeper the earth is broken up, and the more it is pulverised, air circulates, absorption proceeds at a faster rate, and plants attain a more vigorous growth. Deep tillage also increases the capacity of the soil to hold water by capillary attraction in the interstices between its particles. But in wet situations a fine clay may retain too much moisture, and the occupation of all vacuities by water prevents the air from circulating. Land in this condition having its capillary tubes filled with water for some length of time can only produce aquatic plants, such as grow in marshes. Although, of all plants grown for food, rice is the most capable of bearing a saturation of the soil for a long period, and meadow herbs and grasses possess this property also, yet these, particularly the higher varieties, are just like ordinary healthy vegetation, and do best in a soil alternately dry and saturated. In consequence, the feverish anxiety to turn dry land into a submerged and wet cultivation under Government channels and tanks is in some degree an error, though the natives are so short-sighted as to pay a higher rent rather than bestow the labour and manure that deep tillage would require. Rain in tropical climates falls with great force to the ground and closes the surface by a paste which in drying forms a crust, impervious to the air, that is a most indispensable factor in vegetable existence. Some of the finer particles descend into the pores of the soil, and augment the capillary action; and when this is still further intensified by cool weather, water is drawn to the surface and evaporated, and any salt it may contain is left there to the injury of plants. This effect of the rain is counteracted by regular tillage, which loosens the grains of earth, checks the attraction of capillarity, and leaves the water down in the sub-soil out of reach of the heat of the weather Some moisture is, however, apt to be diffused and escape, but Mr. Schiffmayer points out that the action of parching winds may be easily neutralised, especially when blowing always from the same direction, by planting some rows of trees, or a good hedge, on the side from whence the wind proceeds. Soils which have been deeply stirred are apt under heavy rain to close again. But a great amount of organic matter will tend to remove all difficulties, and the soil will be a condition to be worked at almost any season.

Clay, taking up the greatest amount of rain water, which falls generally at long intervals, and allowing it only gradually to evaporate, keeps moist and cool, and is the class of soil best adopted to a warm climate. It is the cooling of the ground under tanks, caused by a evaporation from the inundated fields, that makes vegetation possible in dry weather under the native system of wet cultivation. The dry crops, on the other hand, very often cannot attain maturity on account of suffering from the bad effects of shallow tillage; for the evaporation of water from the plants being greater during the day than the moisture stirred up the preceding night, the tissues of the plants become contracted to such an extent as to be rendered unfit to perform their functions of imbibing water again, so that the plants wither and die. Other plants again will commence flowering when scarcely half grown, the little moisture at the disposal of the plants under shallow tillage not sufficing for the formation of new organs, or the completion of their growth. Water rises by capillary attraction in clay to a height of three feet from the underground level, but in sandy soils seldom higher than a foot That in any case the height is influenced by the temperature is not commonly known, but most important to recollect in India. Wolf observed that the more elevated the temperature, the less is the height to which liquids can rise in the soil. So that in India, unless the land is in a fine state of division, the sub-soil water is driven down in the hot season, intensifying the drought at the surface. But if the sub-soil is open, and the land is in good agricultural order, while at the same time the water level does not lie too deep a considerable quantity may ascend in the form of vapour, into which water is converted at all temperatures. It has been found that in a glass tube measuring five feet in length, and two inches in diameter, which was filled with sand, the water rose by capillary attraction 7½ inches. The upper part of the tube was exposed to direct insulation, yet, after eight days' exposure, the moisture in the upper layer was not changed. All the water evaporated was replaced by the vapour rising from the sub-soil, which condensed in the *surface soil to liquid water*.

It is evident that the physics of the soil enter little into the calculation of either the natives or the administrators of India. Crops are shrivelled up for want of sap, and their *roots* dwindle through a deficient circulation of air, when the *simplest* mechanical operations, and the presence of a due amount of the commonest forms of organic matter in the soil, would enable them to be matured. Mr. Schiftmayer concludes that the capacity of the soil to absorb moisture from the atmosphere is often of itself sufficient to decide the questions whether a crop can be grown on it or not, and whether animal life can find the means of subsistence, or must be left to perish.—*Madras Mail.*

GREEN MANURING.

THE practice of green manuring, although by no means a leading feature of British farm husbandry, is nevertheless not unknown to that system. In ploughing down clover lea for wheat the farmer is resorting to one of the most efficient forms of green manuring. The clover, whose roots run deep and in every direction, has collected and brought near or up to the surface a large quantity of mineral and some organic matter from the soil and subsoil ; the plant has, in addition, obtained from the atmosphere certain organic elements of vegetation, and all of these together are available for the succeeding wheat crop The practice of ploughing clover lea for wheat is, however, not regarded as green manuring , that term is applied to the closely allied practice of growing crops expressly to be ploughed down. In Britain, as already observed, this is not commonly done, but it is not because the practice lacks scientific justification , it is simply because every portion of pasturage or fodder can be utilised profitably by live stock · the crop is, in fact; sold well to the stock, and, in return, artificial manures or feeding stuffs can be purchased to make restitution to the land. In this country it often happens that in the spring-time of year a great deal of feed is unappropriated by stock, and that land remains unimproved year after year for want of the services which a flock would afford if folded according to the English and Scottish systems, between hurdles or nets. During the past few months owners of flocks in newly-settled agricultural areas, and in some of the older ones also, have experienced much difficulty in accommodating their neighbours with the loan of their stock to eat down the early wheats. It is obvious, therefore, that in this country the condition existing in England has no parallel, and that there are numbers of farmers who, for want of stock, may find in ploughing down green crops the best and cheapest method of manuring their land. The question what to plough down is at once suggested, and happily recorded experiment here comes to our aid. In the neighbourhood of tracts occupied by the common fern (bracken) no farmer need want the means of manuring effectively his land if time can be spared to mow and haul the fern. The late Mr. Knight recites, in vol. I. of the *Transactions of the Horticultural Society of England*, some striking experiments with various refuse substances, such as potato tops, ferns, and nettles. His first experiment was with potatoes. In some rows green fern was laid, in others nettles instead of other manures, and with the best effect, and on lifting the crop thus grown the ground was replanted, the green potato tops being laid thickly in some of the rows, and the potatoes were planted upon them in the usual way. "The days *being long*, and the ground warm, and the decomposing leaves and stems affording abundant moisture, the plants acquired their full growth in an unusually short time, and afforded an abundant produce." Market gardeners often employ their potato baulm in this way. Mr. J. Hannam, who recites this experiment, also furnishes some explanation of the causes of the beneficial action of potato baulm. The stem and leaves of the potato contain a large share of the most valuable organic and inorganic constituents of plants. According to Mr. Fromberg, "100lbs. of the leaves in their natural state contain from 82lbs. to 92lbs. of nitrogen, or 100lbs. of dry leaves contains 5·12 to 5 76 of nitrogen. Every ton of potato tops, therefore, adds to the land about 50lbs. of inorganic salts, and a quantity of organic matter containing 20lbs. of nitrogen or about 23lbs. of ammonia. The best Ichoboe gauno did not yield more than nine or 10 per cent, of ammonia, and, therefore, one ton of potato tops may, in this respect, be compared to 2¼ cwts. of the latter." Mr. Knight's experiment with fern was tried upon a turnip crop. The fern was cut in June, placed in a heap for a few days to destroy life in it by fermentation, and then deposited in rows in the soil, the turnip seed being drilled above it. "Some adjoining rows were manured with the black vegetable mould obtained from the site of an old wood pile, mixed with the slender branches of trees in every stage of decomposition, the quantity placed in each row appearing to me to exceed four times the amount of vegetable mould, if equally decomposed would have yielded. The crop succeeded in both cases, but the plants upon the green fern grew with more rapidity than the others, and even than those that had been manured with the produce of my stable and fold-yard, and were distinguishable in the autumn from the plants in every other part of the field by the deeper shade of their foliage." Amongst the crops which are specially adapted for ploughing down green for manure are rape, turnips in the young stage before bulbs are formed, buck wheat mustard, and tares. Turnip leaves and rape will not differ greatly ; these are estimated by Sprengel to contain 1·8 per cent. of inorganic matter. A crop of only about 8 tons of either turnips or rape per acre is thus reckoned equal to ten tons of well-prepared farm-yard manure, and would contain over 300lbs. of inorganic matter. "Now, when the effect of a much smaller dose of mixed saline manures, is considered, it will not appear strange that so much stress has been laid on ploughing in green turnip tops as a means of enriching the soil and securing good after crops." It should be observed that the vegetable matter, whatever it may be, should be ploughed in fresh, and not be allowed to decompose in heaps and lose half its value before being covered with the soil. The choice of crop for green manuring will often in this country be determined by the cost of the necessary seed. Farmers might easily grow for themselves as much turnip or rape seed as would supply their wants for each year ; no transplanting or lengthened occupation of the ground would be necessary in growing seed for such purpose only. Until home supplies are obtainable rape will probably be the cheapest seed to buy ; this, however, each will determine for himself. Before ploughing down it will be convenient to prepare the crop by rolling it, and a circular or disc coulter set to cut the green crop will greatly facilitate the work of ploughing down and of covering thoroughly the manure.

MADRAS IRRIGATION COMPANY.

THE Officiating Chief Engineer of the Madras Irrigation and Canal Company has submitted to the Government his report on the working of the company in the year 1877-78. The chief matters recorded are the failure of the usual rains in June, July and part of August, the actual decrease of the population from famine and sickness ; the poverty and failure of many of the ryots and the great difficulty experienced in making the necessary collections on account of water supplied ; the utter collapse of the village administration and the continuance of relief-works whereby subordinate officers were unable to give any attention to irrigation matters, and the appointment of a sub-collector to devote his whole time to irrigation instead of a native deputy collector. By the appointment of a special officer to look after irrigation work and to give a stimulus to its extension, the Government have done their utmost to benefit the company This appointment was made a few months ago, many difficulties presented themselves to retard the progress of the company, but with the return of normal times and disappearance of famine the newly-appointed sub-collector may be able to do much in inducing the royts to use the water of the canal to a larger extent than before. The failure of rain in the early part of the official year led to great distress and prices having advanced considerably "sent nearly half the population on to the relief-works or placed them under Government support." Although there was a large demand for canal water "applications for large arrears of dry crops were made and in most cases, when possible, water was taken." In many instances remission of water-rate had to be granted as the ryot after taking water and ploughing his land abandoned it for the relief-works. Fever broke out in the villages, and Mr. Wilks says that half the villagers of certain parts of the district perished. The collection of all dues for water suppled by the Irrigation Company rests with the revenue authorities. There were large outstandings and in many cases the ryots, simply because arrears were allowed to accumulate, declined to take water instead of being compelled to pay the whole demand at once. This is a matter to which special attention will be directed. Why should arrears be allowed to accumulate when there are village officers appointed to demand the water-tax. But in a season like the one just tided over, with village establishments in a disorganised state, with village officers driven to the relief-works for their own support, with tahsildars "tied hand and foot to relief-works" it was not possible to give any attention to the demands of the ryots or to induce others to avail themselves of the water from the company's canals. The appointment of the sub-collector, to which allusion has already been made, is "with a view that he may undertake the management of all business between the Government and the canal and to put matters on a better footing." The chief engineer looks forward to the most important results from the action of the Government in this respect. The collector of the district has hardly any time to look after the work of the company or to enquire whether the complaints made by the overseers about the delay of village officers in supplying water required for agricultural purposes are founded on fact. A great deal is expected from the revenue officials being made to "do their duty" in respect to the company, thus putting "confidence in the ryots and soon doubling the irrigation." It is expected that the "much-complained of settlements will be reduced to a minimum if proper means are taken to enquire into cases." Some time ago the Government sanctioned the opening of the

Irrigation Company's canal for navigation, and its extension to near the railway station at Cuddapah so as to facilitate the transmission of produce, especially cotton and indigo from the Kurnool and the adjoining districts, Of the progress which has been made in this direction we learn "that preparations were made to get the required works and repairs so far forward that the boats which are expected from England may be put on the canal and at once through from Kurnool to Cuddapah." English built boats do not answer Indian canals. The boats used on the Godavery and Buckingham canals are country built and are well suited to passenger and goods traffic. Such being the case it is a pity that boats were ordered from England for a venture that has yet to prove remunerative. It was arranged to open the canals for navigation in the present month. Some enterprising Hindoo has already completed a cotton press near the terminus of the Kurnool canal. The whole length of canal, of which the "first sixty-two miles is a succession of tanks with banks reaching to nearly 50 feet in height in two places," was maintained in fairly good order. There were a few breaches here and there, the most serious occurred on the 1st August last which it took twenty days to repair. The unfavourable condition of the season told upon the health of the subordinates, seventy of whom died in the year. At certain periods of the year, one half the entire staff of the company was on the sick list which not only seriously hampered work but actual registration could not be obtained. The income of the company in the year may be roughly said to be one-and-a-half lakhs of rupees, one lakh in Kurnool and the remainder in Cuddapah. The acreage supplied with water showed an increase of 1,091·86 acres of wet crop in Kurnool and 2,245·23 acres in Cuddapah. As to dry crops the figures returned were 22,110·21 acres against 67,932·39 acres in the previous year. The decline under this head is most marked. The acutal amount earned by the company in the year was Rs. 1,89,146 against Rs. 2,10,099 in the year before and Rs. 56,945 in 1875-76.

CAWNPORE GOVERNMENT FARM.

MANY years have elapsed since an experienced horticulturist like Colonel Dickey, then in charge of the Saharanpore Stud, condemned the fruit of a mangoe tope in his grounds on account of its being devoid of flavour by reason of canal water finding its way to the trees, and recommended the guest by whom the luscious burden had been admired, to try in preference at dessert the mangoes produced in his garden by trees that received well-water only. Lately a Government official styled on the *lucus a non lucendo* principal, a director, has been intimating to all whom it may concern that he is prepared to supply young fruit trees reared on the Cawnpore Government Farm, and adding by way of recommendation that the cost of cultivation is much reduced where canal water is obtainable. Have you, Mr. Editor, ever noticed that mangoe topes near which the line of the Ganges canal was taken have, especially where the water runs in embankment, first ceased to bear, then lost their foliage, and lastly stand as withered trunks, evidences of what a flooding of canal water can effect.

The department presided over by the, in other respects, really able functionary I have named, has a high-sounding title, being an off-shoot of the et cetera department at Olympus, but to my humble thinking instead, of meddling with matters it clearly does not understad, it might occupy itself far more usefully and perhaps profitably in introducing, not though through the instrumentality of already overtasked district officers—a more cleanly style of agriculture whereby, the crop and only the crop will obtain all or nearly all—we cannot expect the trim agriculture of Belgium in even a decade—the plant sustenance the soil is capable of yielding.

But it will have to bear in mind that its own unaided efforts to improve the present slovenly style will be unavailing. The native peasant is not insensible to the great advantage a well weeded field has over one that is unweeded, but his impecuniosity prevents his employing hired labor; he does personally what he can, but so much of his time is taken up in attending one or other of our courts at the instance of his rent-raising landlord, and others, that half or a third of the plant sustenance of his fields is drawn off by the weeds, from which, by reason of his enforced absence, he cannot often clear them until the operation is too late to be of much if any use.

The said department might also ascertain by experiment—not again through district officers—*whether* the following method of dealing with "Oosur" soil will not be successful in reclaiming it.

A measured area with parallel trenches of 3 feet or 2 feet depth and 4 feet apart throughout its extent, the *sods* taken from these, and piled in the interspaces, would give such thin, loose walls as are seen round cucumber fields in March and April, which fall in the first rains;—the next operation would be to heap stubble, litter, brushwood, bones, and every description of refuse, to a moderate thickness, but close packed to ensure slow combustion, on both sides of each wall, and a still night might be fixed upon for firing. When the walls have become cool they could be thrown back into the trenches, or better still, this could be left to the rains;—the probabilities are that a single ploughing *across* the trenches would suffice for sowing arhar, and with the addition of a little manure the crops would doubtless pay. Observant travellers may have noticed disused brick-clamps on "Oosur" plains, and in fifty per cent. of the instances it will be found that they are cultivated.

Scattered patches of "Oosur" soil have also been reclaimed by the following accidental process. Cowherds grazing their flocks beguile their leisure by eating the wild plums gathered from the "jhurbari," a bush familiar to all sportsmen;—the stones thrown about germinate in the rains, and as the bushes grow thickly they help to arrest drift sand, the dust with which hot winds and storms are laden, leaves, rubbish &c. These form a crust which is converted by succeding rains into culturable soil, and obviously the process is well worthy of imitation.

A heavily-taxed public will scarcely be brought to believe that the collection of not over-useful statistics, the enumeration and classification(*e.g.*) of the seeds, roots, grasses, and weeds on which the famine-stricken have sustained life is the *raison-d'etre*; of a highly paid department, another of whose late vagaries is what wiser predecessors have tried their hand at before, *viz.*, the improvement of agricultural stock. In all the discussions on the subject no one seems to have discovered that in a country where horned cattle are generally left to pick up what they can, good and regular feeding are essential to improvements, and for this the means of the ordinary peasant are insufficient.—*Delhi Gazette.*

CEYLON PRODUCTS.

WE take the following paragraphs from the Report of the Director of the Botanic Gardens in Ceylon for 1877 :—

Cinchona—Now that the cultivation of *C. succirubra* and *C. officinalis*, has become so extensive in the island, it can hardly be expected that the demands upon the Hakgala nurseries for these species will be so very large as they have hitherto been; supplies of young plants of these will however be kept up. Attention under these circumstances will now be given to raising young plants of the much-esteemed *Cinchona calisaya.* Unfortunately the striking of its cuttings is difficult, but seedling plants will be raised in large quantities, from these will be carefully selected, for distribution, those which best exhibit the normal form of the species.

Tea-cultivation is progressing rapidly in several districts of the island, at different elevations. As it is so well understood that a very superior finely flavoured tea is capable of being produced in the island, planters are doubtless giving their best attention not only to encouraging the luxuriance of the trees, but also to the ascertaining the very best mode for the preparation of the leaves. A large number of plants and seeds have been distributed from this garden.

Chocolate.—There will evidently before long be a very considerable area of land under chocolate cultivation in the warmer parts of the island. Owing to more trees now coming into bearing in these gardens, it will soon be possible to meet a larger demand for seeds than has hitherto been practicable. Every seed we could collect of the last crop was distributed, and fortunately a gentleman possessing an estate near Kandy, was liberal enough to dispose of a certain quantity of his last crop of seeds for sowing purposes

Cinnamon is still being extensively planted upon nearly worn-out coffee estates, and upon other lands considered to be unpromising for more favourite kinds of cultivation; and the results are said to be satisfactory.

Vanilla is likely to be cultivated to some considerable extent, now that favourable opportunities for doing so will be offered by the opening of estates for various products in the low country. There can hardly be a doubt that its cultivation under careful management would be as remunerative here as it is in Mauritius and Bourbon.

Pepper.—The cultivation is extending, judging from the applications being received for plants and seeds.

Ipecacuanha.—I am not able to report any very great disposition to attempt the cultivation of this important plant. A few persons are giving it a trial on a small scale.

Indian-rubber.—The plants of *Hevea brasiliensis, Castilloa elastica* and *Manihot glaziovi* are thriving extremely well both in this garden and in the more tropical garden at Henaratgoda. Propagation by cuttings is being carried on successfully but it must be some time before the number of these plants can be greatly increased in this way. It is to be hoped that in due course seeds will be freely produced by some of the large trees, and then these valuable plants can be disseminated widely and abundantly. These plants were originally obtained from South America by the Indian Government, and have been sent for careful attention and propagation to this establishment, whence plants might eventually be transmitted to Burmah and other parts of India.

Shade and shelter trees have, as in previous years, been disposed of in large numbers. There has also been the usual considerable demand for fruit trees and for ornamental trees and plants. Arrangements have been kept up for supplying demands for flower and vegetable seeds.

PAPER AT THE PARIS EXPOSITION.

THE *Moniteur de la Papeterie Francaise* says :—The house of De Naeyer & Co., of Belgium, has its papers exhibited along with the various kinds of pulps which it uses. The experience of these manufacturers as to the percentage of the different fibres will be interesting to our paper manufacturers.

WOODS.

Common Names.	*Scientific Names.*	*Yield per Ct.*
Heath	Erica vulgaris	27·14
Filbert trees	Corylus avellana	31·50
Alder	Alnus glutionsa	34·30
Bamboo	Bambusa Thonarsu	34·82
White pine	Abies pectinata	34·60
Horse chesnut	Aesculus Hippocastanus	38·26
Oak ...	Quercus Robur	29·16
White poplar	Populus alba ...	35·81
Red pine	Pinus sylvestris rubra	32·28
Elm ...	Ulmus campestris	31·81
Ash	Fraxinus excelsior	32·18
Black alder	Rhamnus frangula	37·82
Fir ...	Pinus sylvestris	35·17
Osier	Salix alba ...	29·50
Canadian poplar	Populus Canadiensis	36·88
Beech	Fagus sylvatica	30·90
Pitch pine	Pinus Australis	31·08
Walnut	Juglans regia	26·52
Willow	Salix alba ...	37·82
Birch	Betula alba ...	38·80
Italian poplar	Populus Italica	36·12
Acacia	Robina pseudoacacia	34·10
Lime tree	Tillia Europea	38·16
Rattan	Calamus verus	29·19
Aspen tree	Populus tremula	35·00

HERBACEOUS PLANTS.

Common Names.	*Scientific Names.*	*Yield per Ct.*
Camelina	Camelina sativa	29·16
Bent grass	Agrostis spica venti	41·02
Buckwheat	Fagopyrum esculentum	30·60
Marsh rush	Scirpus palustris	41·70
Banana	Musa ensete ...	31·81
Mateva	Hyphoene thebaica	26·08
Oats	Avena sativa ...	35·08
New Zealand flax	Phormium tenax	32·71
Asparagus stalks	Asparagus officinalis	32·56
Marsh grass	Glyceria aquatica	38·80
Maize	Zea mais	40·24
Reed	Phragmites vulgaris	41·57
Canna	Canna ...	20·29
Rye ...	Secale cereale	44 12
Giant nettle	Urtica dioica ...	21·66
Sugar cane	Saccharum officinarum	29·15
Barley	Hordeum vulgare	36·21
Sedge	Carex ...	33·86
Wheat	Triticum sativum	43·14
Fromenteau	Baldengera Arundinacia	46·17
Blue flag	Enodium coeruleum	40·07
Hop ...	Humulus lupulus	34·84
Canary grass	Phalari Canariensis	44 16
Wild broom	Spartium scoparium	32·43
Dogs' grass	Triticum repens	28·38

Many of these are exhibited as mere curiosities, as they are not in sufficient abundance to be of any use in manufacture.

POTATOES IN THE NEILGHERRIES.

THE Ootacamund journal writes :—"We noticed a little time back the readiness with which the Burghers take to the cultivation of coffee. Little coffee patches, very models of cleanliness, are to be seen every where. We have now to notice the great progress that the cultivation of potatoes has made among this hill tribe. Not a hamlet but is surrounded with flourishing potato plots. A large proportion of the potatoes brought now to market is the property of Burghers, and they hawk it about, from house to house, selling it at rates extremely moderate. It is fortunate for the potato consumer that the Burghers have taken to the cultivation of the tuber as between the misguided prohibition by the Ootacamund Municipality of the cultivation of potatoes within the limits, and the appearance of disease on the repeatedly cropped fields adjoining, a serious deficiency of this esculent was apprehended. The deficiency however was temporary and has probably now altogether disappeared."

THE GARDEN.

A FLORAL CLOCK.

APPROXIMATE hours of opening of the following flowers in temperate climates :—

Ipomoea Nil	3 to 4 A.M.
Tragopogon pratense (Goats' Beard)	4 „ 5 „
Papaver nudicaule (Poppy)	5 „ 0 „
Hypochoeris maculata	6 „ 0 „
Various species of Sonchus and Hieracium (Hawkweed)	6 „ 7 „
Lactuca sativa (Lettuce)	7 „ 0 „
Specularia speculum (Venus' looking glass)	7 „ 8 „
Calendula pluvialis (small Cape marigold)	7 „ 8 „
Anagallis arvensis (Pimpernel.—The "shepherd's warning," or "Poor man's weather glass"), opens only in fine weather	8 „ 0 „
Cichorium Intybus (Wild succory or chicory) And closes at 4 P.M.	8 „ 0 „
Nolana prostrata (Trailing bell)	8 „ 9 „
Calendula arvensis (Corn-field Marigold.)	9 „ 0 „
Arenaria rubra (the red kind)...	9 „ 10 „
Mesembry anthemum nodiflorum (Knot-flowered Fig-Marigold)	10 „ 11 „
Ornithogalum umbellatum (Star of Bethlehem, known in France as the Dame d'onze heures)	11 „ 0 „
Various Ficoideus plants (belonging to the Mesembryanthemum family)	12 Noon.
Scilla pomeridiana (Squill)	2 0 P.M.
Silene noctiflora (Night flowering Catchfly)	5 „ 6 „
Œnothera biennis (Evening Primrose)	6 „ 0 „
Mirabilis jalapa (Marvel of Peru)	6 „ 7 „
Cereus grandifloras (Torch Thistle.—Night-blooming Cereus)	7 „ 8 „

Partially extracted from Balfour's *Manual of Botany.*

G. P. P.

HINTS TO AMATEUR GARDENERS.

THE first desideratum to a successful garden is a good fence if boundary walls do not protect the compound. Cows and goats, the latter especially, make sad havoc of one's choicest plants, as native gardeners are never sufficiently alert to keep cattle from straying in. With a little care the surrounding hedge may be made not the last attractive part of the garden. There is a very wide selection of hardy plants to choose from, all of which thrive well in the plains. There are the *Jasminum*, well known for its fragrant white starlike flowers. Its scent is sometimes too powerful to be permitted in too great proximity to the dwelling house, but it answers admirably for a fence, its rarified aroma carried on by the evening breezes scattering a sweet perfume all through the house. The pomegranate is also a fine fence plant; a hardy grower, needing but little care. Its bright scarlet flowers afford a brilliant and effective contrast to the delicate white petals of the Jasminum, if planted alternately. The fence may yet further be variegated by the rich brown and yellow flowers of the *Poinciana pulcherrima*, which will grow with moderate watering and care. These three shrubs should furnish a very handsome fence—the *poinciana* for the entrance and close, with alternative *jasminum* and *pomegranate* for the remainder. The fence being complete we will now devote our attention to the garden itself. But before we do so we would impress on amateurs the necessity for bird life in their gardens. There are no better grub destroyers than the bird commonly known as the *mina*, several of which we imported into our garden with admirable results, and should there be a paucity of small birds no better investment can be made than in *minas*. Having disposed of the birds we will turn to the garden. The plan of the garden must be left to each one's taste, but simplicity should not be sacrificed to the ornate. Native gardeners are usually, if properly handled, very quick in picking up designs, and with the help only of a piece of string and a peg will work out the most elaborate plan that may be entrusted to them. The plan being selected and mapped out, there comes the important matter of manuring. It will always be found most satisfactory to dig deep and manure well at the outset. The reason is obvious, there is always water and damp to be found if you dig deep enough, so that if the upper soil is well broken the tender roots of the plants will be enabled to force their way through the loosened earth. Of manures there is a very great variety. We will only refer to a few. For common use *burnt* earth is admirable. Take a few spades full, cut square. Place them in the form of a native fire place, and burn them;—the effect is admirable. We would recommend this as the basis of all beds. (We are now alluding to plants that are placed in the ground. Not to those in pots). With this mix leaf compost, *i. e.*, leaves and green stuff that has been buried with earth until it has decomposed, river sand, and finally one part, about one-sixth of the whole of *very old* horse or cow's manure. It is important that the manure should be old, for, if new, it is too heating and will probably require more watering than the gardener will give it. It is always necessary to have a pit dug in a corner of the compound into which all leaves, clippings from plants, ashes and cleanings from the kitchen may be daily thrown, with a covering of earth. In fact a gardener can hardly do justice to his plants unless he has this to help him on. For here and there a plant less hardy than its fellows will need more coaxing with manure than the rest—hence the necessity for this store at hand.

The beds being manured and laid down, we now advance to forming the borderings. These are like the delicate lines that pick out the uniform colour of a carriage and should be neatly trimmed, a straggling border detracting from the effect of a pretty bed. For bordering we would commend any of these hardy growers :—Frosted foliage *maritimes:* golden foliage, *gold feather*, crimson foliage, *dells deep crimson beet*, and bronze foliage, the *coleus*. With these might be intermixed the *paradanthus tithymalowes.* A very pretty effect we have seen given to these borders by growing the large flowered convolvolus with them, making it to trail in and out between the other shrubs—a pure white, or deep purple convolvolus in juxtaposition with the gold feather or crimson beet looks admirable. It requires but careful training at the beginning, and will well repay such care. Having completed the borders the next stage is to get the plants ready for the beds. We do not advise the plants to be raised on the beds themselves, they will never as a rule thrive well if this plan, so common with gardeners if left alone, is adopted. The wiser course is to prepare low pans with rich soil—say one part sand, one part burnt brick, one part braty ashes, and one part leaf mould varying with the requirements of the seeds. Place the pans so that they may be sheltered from the direct rays of the sun and moon and yet have a sufficiency of light and air. We do not approve of the plan of covering over the pans with leaves or mats, and think that amateurs will do well not to use these protectors. On sowing the seeds cover them with fine leaf compost and burnt earth mixed together, in equal parts, throwing, as a general rule, only as much earth over the seed as will correspond to their circumference. It is a much-vexed question whether seeds should be watered after sown. Our own practice is to water the pan freely after it is prepared, to let it lie for 24 hours and then sow, but not to water until twenty-four hours latter, and then with a rose sprinkler, taking care not to disturb the axis of the seeds. After a few days, when the plants look sufficiently strong to be transplanted, water the pan well to render the earth yielding, and then insert the hoe so that three or four plants are lifted together. Move these into the beds intended for them taking care that holes sufficiently large to receive them, and lined with leaf mould, are prepared to receive them. They should at first be watered daily, *after sunset*, but not deluged with water. After they have grown a bit, water more freely until they attain their full growth, when they need be watered well at the same time once in 48 hours. A little liquid manure will occasionally, once or twice a week, be found essential to the plant's growth in their earlier days. Liquid manure is made by soaking the dung of any kind of cattle (about a spadefull to a gallon of water) for a day and then draining off the water, perfectly free from the manure. Should this not be readily procured, soap suds—the water in basin after use—will be found an efficient substitute.—*Madras Times.*

AGRI-HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Thursday, the 19th September 1878.

W. H. Cogswell, Esq., *V.P., in the Chair.*

The proceedings of the last meeting were confirmed.

The following gentlemen were elected members :—

Rai Jung Bahadoor, Rai, Balkrishna, Messrs. Herbert Ramsay, Alfred Anderson, T. Walton, A. Forbes, Secretary, Cantonment Fund Committee Morar, and Shaik Sabiuddin.

The names of the following gentlemen were submitted as desirous of joining the Society :—

James Caldwell, Esq., Emigration Agent for Natal,—proposed by Mr. A. Firth, seconded by Captain C. J. Wilkinson.

Shaikh Ahmed Ali of Behar,—proposed by Baboo Bimala Chunder Bhuttacharjee, seconded by the Secretary.

Alfred W. Nevile Wyatt, Esq, Bhukean, Indigo Factory, Tirhoot,—proposed by Mr. W. H. Cogswell, seconded by Mr. John Thomas.

Robins Cooke, Esq., of Doolubcherra, Cachar,—proposed by Mr. Joseph Binning, seconded by the Secretary.

Garden.

The Gardener's monthly report was submitted, of which the following are extracts :—

"The chief work during the past month has been potting off goties and cutting, and miscellaneous propagation, with the object of getting as large a stock as possible before issuing the same. Orders have come in briskly, and have been executed as per demand, as far as the stock in hand permitted; members especially those at a distance would greatly oblige if they were to add a secondary list to their indents for plants, to prevent disappointment and delay in making up orders. We have a fine stock of large sized Crotons suitable for hall, staircase, or verandah decoration: *Caffea Arabica* we have over 2,000 plants three feet high and upwards; a small batch of a Avocada Pear (*Persea gratissima*) are available. Cuttings of Liberian coffee have been put down, they are all healthy, but only form a 'callus' after 1½ or 2 months, would perhaps get on better with bottom heat. Two of the large plants out in the garden have a quantity of berries (30-40) on them, but they are very slow at ripening or even colouring; after increasing to their full size in a green state, the outer skin turns black and shrivels up in a few days and the berry falls down. The seeds from these berries on examination are apparently fully developed, but have hitherto failed to germinate."

Letters were read—

From the Secretary Tukvar Tea Company, forwarding specimens, in various stages, of red-spider.

From E. L. Edgar, Esq., of Cossipore Garden, Cachar submitting specimen of an insect which he has not observed before, found on a partially eaten tea leaf.

From F. Moore, Esq., of the India Museum, London, expressing a wish for specimens of red-spider and other noxious insects for examination.

The Secretary mentioned he had sent the above specimens to Mr. Moore.

From the Assistant Secretary, Department of Agriculture and Commerce, requesting the aid of the Society towards obtaining hybrid tea seed for trial in the Arakan Hills. (To be complied with.)

From the Director, Agriculture and Commerce, N.-W. Provinces, applying for a large quantity of Guinea grass seed for next year's sowings. The Secretary stated he was endeavouring to meet this application.

From a correspondent in London on the subject of the fruit of the Bengal date, and whether it could be profitably exported; and he adds, "I am at a loss to know why the superior Phœnix *dactylifera* is not cultivated in Bengal in lieu of *P. Sylvestris.* I have had both kinds in my garden (in Calcutta) and found the former to grow at least as well as the native description. The consumption of Persian Gulf dates in this country is now enormous, and, notwithstanding their very low prices, say £6 a ton, they are still apparently a paying crop."

The Secretary remarked that the question of the introduction of the Arabian date into Bengal had been discussed several times by the Society in past years, but he was not aware if it had been carried out to any extent. A former Commissioner of Patna, Mr. Ravenshaw, had tried it but found the trees very slow of growth as compared with the Indian date. Large quantities of the Persian date were allowed to rot on the ground according to the *Times* correspondent for want of carriage to the sea board.

FORESTRY.

TIMBER MEASURING.

In taking the dimensions of timber lying on the ground, the process is simple, but the results are different according to the article used for measuring the girth of the tree. A thin piece of whipcord, a thick cord similar to a garden line, or a properly graduated tape or leather strap, each give different results in the dimensions.

The doubling up of thin whipcord into four lengths, for the quarter girt, does not subtract much from the actual circumference, divided by four; but the thicker cord loses in bending a very perceptible quantity; while the tape line, or a leather strap, gives larger dimensions than either of the former, because there is no doubling to reduce the circumference, as the quarter girt is shown at once by the graduation on the back of the tape; and from the broader surface which it presents to the tree, it cannot fit into irregularities in the bark so readily as a small cord; and conseqently gives greater dimensions than the cord; except in the case of peeled timber having a comparatively smooth surface, when the dimensions assimilate more closely. Sometimes a purchaser will insist upon a slight allowance being made when a tape or strap is used, to compensate for the doubling of a cord; this objection can be met by not meeting the tape quite close in girting, leaving about three-fourths of an inch between the meeting of the fingers, which will be ample compensation for the doubling of a cord. However, I have measured many thousands of trees with Chesterman's patent graduated timber measuring tapes, without making any allowance whatever, or even having it asked for by the buyers. These tapes can be had in various sizes, either in cases, or loose to hang over the arm or carry in the hand. For small trees I prefer the short loose tape; but for large timber I use a tape about twenty-four feet long in a compact leather case. The case will last out a great many tapes, which cost little to buy loose, and are easily inserted in the case by unscrewing and taking out the axle or roller upon which the tape is wound up. It will be seen how the first one had been attached; take it off, and attach the new one in the same manner, push in the roller, and screw up as at first. Another tape, by the same maker, may be had in a brass box, coiled upon a spring, which saves much time, and trouble in winding up. These are made in twelve feet lengths, and may be had either of linen or steel. Being much narrower than the ordinary tape, they clip to the tree, more like, a cord. One class of these tapes can be had with a cattle gauge attached, for ascertaining, the weight of cattle by measurement. The gauge has a circular slide, and after taking the dimensions of the animal in the usual way, the dead weight of the four quarters can be quickly and pretty accurately ascertained in stones of 8lbs., 14lbs., or in scores of 20 lbs.

In taking the dimensions of timber when trees are of a regularly tapering description, the girth is taken in the middle of the length of the tree—for the mean girth—but when the trees are irregular in form, the dimensions may require to be taken in several parts, each part having a distinct entry in the field book.

The following is a very simple form of book which I use when valuing for a sale, or for a general measuring :—

Lot	No. of tree	Length.	¼ girt	Contents	Total	Rate	£	s.	d.	Remarks.
1	1	12	27½	63						
,,	,,	18	10	12½						
,,	,,	24	10	16½						
,,	,,	12	11¾	11½	103½					
						2s.	10	7	0	
				Tops	50					
,,	2	14	19¼	36		9d.	1	17	6	
,,	,,	18	10¼	13	49					
,,						1-10d.	4	9	10	
				Tops	16					
,,	,,	•				8d	0	10	8	

When measuring standing timber the contents of each tree should be carried out in going along, price per foot noted, and occurring remarks made in the margin. The computation can be easily and speedily accomplished by any one with the aid of a common slide-rule, which can be carried in the hand along with the book, and each computation effected in an instant almost.

In computing the contents of timber by the common slide-rule, the line C on the slide, and the line D on the rule are the only lines used. To ascertain the contents of the piece of timber according to *customary* computation ; set the figures on the line C, which represents the length of the piece, opposite to 12 on line D, then opposite the figures denoting the side of the square—or quarter girt—on line D you will find the cubic content in feet on C. Example :—What is the contents of a piece of timber, 25 feet long, and quarter girt 15 inches ?

S et C 25 length ———— 39 contents.
D 12 ———— 15 quarter girt.

But as the customary method of computing the measurement of timber does not show anything like the real contents, this can also be easily ascertained from the slide-rule, by selecting another Gauge Point on the line D. I have not seen any slide-rule with this G. P. marked on the rule by the maker, but I discovered it for myself, and marked it upon the rule I use, either with the point of a pen-knife, or the point of a pin driven into the rule at the proper place, which is 10·625 on the line D. Then set the lengths in feet on C to 10·625 on D, and opposite the quarter girt on D, are the true contents on C. Example :—What is the actual cubic contents of a regularly tapering tree, the length of which is 28 feet, and quarter girt 14¼ inches ?

Set C 28 ———— 52 real contents.
D 10·625 ———— 14¼ quarter girt.

Whereas by the former or customary method of computation the contents would be about 41 feet only, making a difference of 11 cubic feet in a tree of that size.

The most convenient size of rule for the pocket, and for general usefulness, is either the 3 feet four-fold, or 2 feet four-fold rules The latter having the slide only 6 inches long, and the graduation. not so numerous as on the former, does not admit of such nicety in calculation, as the eye has to judge what the quantity ought to be between the graduation, therefore I recommend the former for beginners' but on either of these common rules the space on line D between 10 and 11 is only divided into four spaces or quarters. Therefore, to fix the Gauge Point for computing the actual cubic content of round timber ; place a mark exactly half way between 10½ and 10¾ and the thing is done.

There are various excellent slide rules to be had by which elaborate computations and calculations can be rapidly and accurately made. Bayley's slide rule, manufactured by Messrs. Elliot, of 144, Strand, London, is an excellent instrument. applicable to calculations of every kind. Hoare's is also an excellent rule, exceedingly useful, easily. manipulated, and very portable ; but for the requirements of the forester for timber measuring, the common slide-rule is sufficient for his purpose, and not costly.—A. P. in the *Journal of Forestry*.

SANDALWOOD IN MYSORE.

IT is well known that the revenue derived by the Mysore State from sandalwood grown in its forests is very large ; the tree springs up from self-sown seed and grows luxuriantly in many parts, and being a State monopoly it is protected from indiscriminate felling, while of late increased care has been paid to its protection and culture by the Forest Department, as a further protection against the felling of sandalwood, the Supreme Government has hitherto restricted the cuttings of sandalwood to 500 tons of growing trees annually, no limit being placed upon the collection of dead and decaying wood, and digging out roots. Lately the local Government have recommended the number of mature sandalwood trees should be increased considerably, explaining that while the collection of this wood at present and for some years past has been restricted to old roots and dry trees, as a rule, no green wood or growing timber has been felled. The Mysore Government in making this recommendation points out that the number of mature trees has considerably increased, specially in the forests of the Nagar Division, but while it is difficult to form any definite conclusions, from the absence of precise data, of the present and former growing stock of mature wood, the concurrent testimony of the Civil Officers and the Conservator of Forests leave no doubt that a large number of mature trees exist which may be cut with advantage now.

Taking this into consideration the Supreme Government has conveyed its sanction to annual cuttings of 1,000 tons extra in addition to the ordinary 500 tons, leaving the details to be arranged by the Chief Commissioner of Mysore, but pointing out that the Government of India is bound not diminish the capital value of this important monopoly of sandalwood, which it administers in trust for the Mysore State. Obviously therefore the selection of the trees to be cut must be made with due regard for the maintenance of the future supply of sandalwood, and so as not to endanger the reproduction of this tree from self-sown seed. The cuttings must be arranged so as to leave a sufficient number of seed-bearing trees on the ground wherever the tree is likely to grow. For this the Conservator must be held responsible, and the operations must be conducted entirely under his direction and control.

It has been the opinion of those qualified to judge that the sandal forests of Mysore would bear more cutting than has hitherto been carried out, without such being detrimental to it, but probably the fear of causing a decrease in market prices may be one of the reasons why the felling of the wood has been restricted. The province is however now in debt and in order to meet liabilities, no doubt every nerve is to be strained, for we read that the Chief Commissioner " regards the matter of collecting extra sandal specially important at this time when, by every legitimate means, the revenue of the province should be promptly increased

Captain van Someren, who has been called on to report on the arrangements he intends to make, proposes that the whole of the additional felling be confined to the Nagar Division as it has the largest quantity of matured wood. This officer remarks that the great difficulty to be experienced is in regard to storage for the wood when cut and suggests arrangements with reference to the utilising of some old buildings in Kadur, Hassan, and Seringpapatam, which if carried out might meet this difficulty ; orders have been issued accordingly. One of the young men who has just passed the examination out of the School of Science has been told off for the work of supervising the felling of sandalwood under the immediate charge and orders of the Officer in charge of Nagar.

The immese forests of sandalwood for which Mysore has been long celebrated have been more recently under the Forest Department carefully conserved, and the working of the Forests annually yield a good addition to the revenue. From a very early period sandalwood was a royalty to Govenment. It is cursorily refered to by Colonel Wilks, in this report of 1804 (para 163), but no statistics are given nor does it appear as a separate source of revenue in the accounts till 1833-34, when it realized Rs. 30,000 and 1835-36, the unprecedented sum of Rs. 3,16,000. The annual realizations shew considerable fluctuations varying, it is presumed, with the supply and demand. During the first ten years up to 1841-42 the receipts aggregated 13½ lakhs, during the next decade 16½ lakhs, and in the next 17 lakhs, up to one year 1861-62. The sale of timber is not shown in the accounts until 1857-58. In 1863-64 the Forest Conservancy Department was introduced and its control has been gradually extended over tracts, which until 1872 were under the management of the ordinary revenue establishments. The financial results attained before are since the introduction of the new system of Forest Conservancy into Mysore are seen from the following figures :—in 1833-43 the surplus was Rs. 127,890 : from 1843-53, Rs. 145,683 ; from 1853-63, Rs. 175,585 ; and from 1863-73, Rs. 231,473.—*Bangalore Spectator.*

FORESTS IN INDORE.

WE quote the following from the Administration Report of the Indore State for the year 1877-78 :—" The fuel supply to the railways has entirely ceased from our forests, the authorities being supplied from the British forests of Maupore districts and from the Dhar jungles by Mhow Bohoras at a very reduced rate. The profit which we realised last year on this is completely lost.

" We have done our best to conserve the jungles under our charge. The nakódars have done their duty well in more ways than their legitimate duty authorized them. They helped to put out jungle fires, catching robbed cattle, preventing robberies and otherwise guarding our forests. Our patrols also added very much in this work.

" Our nurseries have been a complete failure this year, owing to want of water supply. I have, however, instituted another plan, *viz.*, that all zardars in our forest shall sow seeds of various jungle trees in several parts of their waste lands, which at one time were under forest, and now completely become waste useless land, unfit for cultivation. The Forest Department will also sow seeds and transplant the young trees to various parts of our waste lands. If this is carried out properly, we shall be keeping up the supply of fuel which is in large demand from Indore and Mhow. *Mowha* seeds have been ordered to be sown in large quantities.

"I have started the sowing of jungle tree seeds in five districts near Indore, *viz.*, Hatode, Betma, Depalpore, Samwere and Indore, with the view of the country being in a few years studded with fine trees planted on tops of bunds around tanks, along the banks of rivers and in waste lands. We ensure shade for cattle, leaves for manure. These trees ought to cool the country and possibly will attract rain, which we sadly want in certain districts; at first there will be some little trouble in taking care of the young trees, each village being responsible for the care of the watering during the dry season, but I feel sure when the people see the good to be derived they will themselves increase tree culture.

"Our grass-collecting has been beneficial in many ways, but now that the rail is open to Indore the traffic along the Khundwa and Indore road is almost entirely stopped; so, in future, we shall not collect depôts of grass along the road. I have stacked about one lakh of *poolas* of grass at Indore, on trial, but I fear the results as to profit; grass is sold very cheap in Indore by owners of *beeds* within twelve miles of cantonments; they bring in small quantities at a time in their own carts and by so doing quite under-sell my store as I have to bring my grass quite 30 miles in hired carts.

"Lac has not turned out well, at least as far as profit goes. Through the year 1877-78, I have tied lac on 2,385 trees above the Ghats in the Indore district, and below in Burwai 1,794 trees, Maheshur 200 trees and in Brahmangaum 631 trees, making a total of 5,010 trees on which we found lac on 882 trees and tied lac on to 1,043 trees; so in two years we have a total of 6,935 lac-bearing trees.

"I have now given up collecting lac. The statements herewith sent show that it does not pay. The pay of the inspector swallows up the income. I have recommended the Durbar to pass on this lac-collecting into the hands of the ameens of the different districts. They can collect it at a cheaper rate than I can. If I send a man out to tie and collect departmentally, he always brings in a heavy bill; so I recommend, in future, the lac should be done by contract from the ameens' courts. The lac is spreading over the districts, as you will see by the report, and very possibly could increase still further if the inspector had a greater interest in it. As long as he is paid a salary, he does not trouble himself much, but if he be paid a percentage on all collected at a certain rate, possibly the next year's return would show up better.

"I am sorry to say this year has not been so profitable as 1876-77. In that year you are aware Rs. 17,000 was paid into the Treasury. Then we had large supplies of engine fuel and logs to the Railways. This year we lost all that and our profit of Rs. 7,000 is simply from jungle produce.

"*Prickly Comfrey.*—A small quantity of the Prickly Comfrey roots was obtained and its cultivation was tried in the year. I am of opinion that, as a fodder, it is a failure. From the experience it has been found that it grows well only on irrigated soil and such a fodder is not profitable in India."

BOXWOOD IN THE HIMALAYAS.

FOR some years past the supply of this important wood has diminished in quantity and risen in price. It is derived from the forests of the Caucasus, Armenia, and the Caspian shores. The wood of best quality comes from the Black Sea forests, and is principally shipped from the port of Poti. The produce of the Caspian forests, known in the trade as " Persian " wood, until last year was also imported through the Black Sea from Taganrog. This found its way after the commencement of the war *viâ* the Volga canal to St. Petersburg. The produce of the Caspian forests is softer and inferior in quality to that of the Black Sea. It is a matter of interest to see whether one result of the war will be to open these Black Sea forests which the Russian Government has hitherto kept rigorously closed.

The failing off of the supply has led meanwhile to various attempts to find substitutes for boxwood for many purposes. Messrs. Joseph Gardener and Sons, of Liverpool, have introduced with some success Cornel (*Cornus florida*) and Persimmon *Diospyros Virginiana*) for shuttle-making, for which purpose hitherto box has been in great demand.

The diminished supply has also drawn attention to the Himalayas as a source of supply. Dr. Brandis, the Inspector-General of Forests in India, has corresponded with Messrs. Gardener on the subject. I am informed, however, by Mr. Godfrey Saunders of this firm that " the difficulty of transit from the mountains to the seaboard appears to be the great obstacle, and in addition the possible supply appears to be much smaller than is furnished from existing sources."

Mr. Robson J. Scott has presented to our museums blocks prepared for wood-engraving of hawthorn, which he states "is by far the best wood, after box, that I have had the opportunity of testing."—*Report on Kew Gardens.*

THE MADRAS FORESTS.

ACCORDING to latest returns of the Forest Department, no new reserves were opened in the districts of Madras in the official year 1876-77. The reserve forests cost Rs. 1,61,778 and the estimated value of the timber on them is above five-and-a-half lakhs of rupees. The receipts have increased somewhat, and the charges declined by about five thousand rupees. Besides fuel reserves, the Forest Department maintain plantations, the charges on which decreased in the year. The value of timber felled was 50 per cent. more than in 1875-76, while that of timber sold is less than in the previous year. In many places felling was carried on more extensively than was necessary. The Conservator of Forests has, in accordance with the orders of the Government, made up a list showing forest acquisitions in the different divisions since the commencement of conservancy arrangements in the Madras Presidency. There are eighteen different plantations in the Cuddapah district; one is a reserve of between eight and nine thousand acres in extent, twelve miles west of Rajampett station. The jungles attracted the attention of Mr. Horsley, the Collector, in 1876, and Red Saunders were planted out. The tract will not be enclosed till the Conservator makes a personal inspection of it. There are but two forest tracts in the Kurnool district that have been acquired by the department; in the North Arcot district eleven acquisitions have been made; in Trichinopoly twenty-one, three of which only are above a thousand acres in extent; the department has eight estates in Madura; in North and South Coimbatore there are five plantations, one of which was purchased by the Government about three years ago for Rs. 2,500. The property was sold for arrears of rent. In the Neilgherry district there are some valuable and extensive plantations; one of which belongs to the Tirumapad of Nellambur and was leased for ninety-nine years from 1862 at an annual rental of 3,800; the estimated value of the property is six-and-a-half lakhs of rupees and was acquired when Sir William Robinson was collector of Malabar. There are three other estates on the Neilgherries in charge of the department, one is valued at five lakhs and another at one lakh. In the last plantation sandlewood is largely available. Salem has only three plantations belonging to the department. The Nelambur plantations in Malabar which are 2,000 acres in extent, are the most valuable in charge of the department. They were acquired through the collector of the district some years ago and are chiefly planted with teak and jungle trees; the prospective value is set down at three crores of rupees. The department owns two large forest tracts in Palghaut—both are planted with teak, blackwood and crool but no value has been set upon them. Nine hundred and ninety-nine persons were tried in the year, for committing breaches of forest rules and of these 469 were convicted, chiefly in the Tinnevelly district, where forest officers are empowered to punish such offences.

BLACKWOOD AND SANDALWOOD IN MYSORE.

AMONGST the varieties of timber produced in the indigenous forest of Mysore is the blackwood, known generally as "rosewood," among the timber merchants and workmen. The Conservator of Forests has lately instituted some enquiries regarding the demand in the local market for this timber, and reports that from the enquiries he made his opinion is confirmed that it is but seldom sought after. Blackwood makes up into handsome furniture for houses, such as tables, chairs, sofas, wardrobes, &c., but is found to be too heavy for joints, rafters, beams, &c. used in buildings. Captain Van Someren recommends that it should be used as much as possible in making up furniture for all Government offices, taking the place of teak in screens, shelves in walls, almirahs, &c. There is plenty of blackwood producing trees in the forests of Mysore, the wood is sound and runs large, so that excellent slabs and planks can be got from it. It would be worth trying the experiment of getting in a supply of the logs selling them at the various depôt sales; perhaps the knowledge of stock on hand would create a demand which might annually increase.

FOREST-PLANTING IN FRANCE.

THE *Revue des Eaux et Forêts* gives a *résumé* of satistics derived from official sources, showing that in 1875 various communes in France replanted as forest rather more than 814 hectares of land. Towards this work the State contributed 29,054 francs in money, and seeds of plants to the value of 27,828 francs. In the same year 347 hectares were replanted by private owners, with the assistance of a Government contribution of 13,705 francs. The works of the same nature undertaken by the State itself in various mountainous districts of the country were on a far larger scale. At the end of the year 128,269 hectares had been taken in hand, of which 29,400 were completely stocked. The trees required for this purpose are supplied by specially established nurseries, covering altogether an area of 82 hectares, which yielded in the twelve month no less than 19,117,000 plants. It may be in the recollection of our readers that the department of woods and forests, which formerly was attached to the Ministry of Finance, was incorporated last December in the Ministry of Agriculture and Commerce.

AVENUES IN MYSORE.

MANY fine avenues of trees are to be seen along the various high roads in Mysore. The old road to Madras *viâ* Ooscottah and Kolar, in some portions is regularly canopied by overgrowing branches. These avenues formerly were planted as charitable acts by Gowdas, large landed proprietors, inamdars, &c., but latterly Government have carried out the planting of trees along all new roads opened out. Out of 3,818 miles of road in the province, 3,627 miles have been planted with trees on both sides.

TIMBER TREES OF THE SEYCHELLES ISLANDS.

Sideroxylon sp. "Capucin."—A large growing tree. Timber hard, almost undestructive either in water or in the atmosphere, used for beams, wall plates, frames of wooden houses, verandah posts, piles, planks, shingles, spokes for wheels, &c.

Calophyllum inophyllum. "Takamaka" or "Tacamahaca."—A large growing shady tree always found on the sea shore. Trunk 4 feet in diameter. Timber tough, coarse-grained, not easily worked, colour reddish, used for boards, planks, beams, ship and boat building, masts, Cocoa-nut mills are dug out of the root end of the tree and excellent canoes ("Pirogues") are made (hollowed) out of it. The exudation from the stem is the *Tacamahaca* resin of commerce. Its seeds yield the bitter oil of India, which is said to be worth £90 per ton. This oil has a great reputation in Polynesia and the East Indies as a linament for rheumatisims, pains in the joints, and bruises, and its efficacy in these respects can hardly be exaggerated. The uses of the oil and resin are unknown in Seychelles.

Dipterocarpus sp. "Bois de fer."—This is a large lofty growing tree, often attaining a height of over 190 feet, with a trunk 40 to 70 feet to the first branch, and a diameter of from 4 to 6 feet; is in great repute for making canoes. Timber resembles teak in colour and grain, hard and durable, used in all parts of house building, boats, &c. This is perhaps the most useful timber of the Seychelles islands, for general purposes. When the tree is wounded there exudes an almost transparent resin which is exceedingly inflammable, and was formerly used as incense.

Afzelia bijuga. "Gayac" or "Faux Gayac." Yields a very fine and durable timber. In colour it is not unlike the last, and is used for the same purposes. It is now very scarce, and few living trees exceed 8 inches in diameter.

Terminalia Badamia. "Badamier."—A large growing tree, from which canoes are frequently made. Timber is generally used for boarding inside of houses, &c., will not bear wet and exposure to the atmosphere.

Imbricaria petiolaris. "Bois de Natte."—A large and lofty growing tree, trunk often attaining a height of 50 feet. It is now becoming very scarce. Timber used in all parts of house building, cabinet work, &c. It is dark coloured, close and fine grained, hard and durable. It makes beautiful furniture, and when well polished it almost rivals the finest mahogany.

Gomphrandra sp. "Bois Marie."—A middling sized tree, whose wood is used for boards and planks in house building. The timber is of a dirty white colour, and not very durable.

Wormia ferruginea. "Bois Rouge."—Is an ordinary sized tree. Timber red colour, hard and durable, bears exposure well, and is in great repute for flooring, and roofing houses.

Heritieria littoralis. "Bois de Table."—A large growing tree, not common. Timber used in house building, furniture, &c. It is close grained and dark coloured, and its quality is excellent.

Rubiaceæ sp. "Bois Sandal" or "Sandal."—A small tree. Trunk seldom exceeds a foot in diameter and 20 feet in height. Wood close-grained, easily worked, polishes well, beautiful pale yellow colour, used for ornamental work in the inside of houses, furniture, panelling, and occasionally boards, &c.

Campanospermum Zeylanicum. "Bois Montagne."—Occasionally attains large dimensions. Held in great repute for making canoes, which are said to be very durable. Timber used in house, ship and boat building, &c.

Casuarina equisitifolia. "Filao" or "Cèdre."—In Seychelles this tree attains a gigantic size. In 1871 I saw one whose trunk was 150 feet in length and 6 feet in diameter at about 20 feet from the root, lying on the beach near St. Anne's Bay, Praslin. In 1874, I saw several trees of it, growing on the beach at Curieuse Bay, Praslin, that were 120 feet in height, and straight as arrows. They appeared to be comparatively young trees. Its timber is used in all parts of house building. It is close grained, and sinks in water when it is green. When kept dry it is very durable, but decays quickly when exposed to moisture. It is nearly impossible to draw nails out of it. It makes excellent firewood, and burns freely even when green. It is indigenous to these islands, and grows readily from seed which may fall on cleared ground.—*J. Horne.*

MINERALOGY.

COAL SEAMS IN THE THAYETMYO DISTRICT.

WE make the following extracts from Dr. J. R. M. Robertson's, report on these seams as exposed to view on Thapan *choung* about one mile south of the village of Tsang-sin-kin, and 13 miles north, west of Mengdoon :—

"The openings that had been made before my arrival, and from which a few tons of coal had been recently extracted, were sufficient to raise in my mind a conviction that the openings had been made, not into one, but into several separate and distinct coal seams. These openings were, with one exception, situated along the east flank of a low ridge running very nearly north and south, the strike of the strata varying from N. 10 W. to N. 20 W.

"Acting upon the above conviction, I directed several cross-cuts to be made at right angles to the strike of the beds at various points, both within and without the limits of the previous prospections; by these means, not only the continuity of the beds was proved over an increased distance along the strike of the beds, but at the same time the existence of at least *three*, if not *four*, separate seams of coal was demonstrated, and a great deal of light thrown upon the formation and character of the beds. The conformation of the ground in proximity to the seam marked No. 1 on rough plan appended, and especially the "faulty" or "troubled" nature of the mineral itself as it is exposed to view on the margin and dipping below the waters of the *choung*, did not permit me to identify it with the other seams further to the south; but I am of opinion that it is a distinct bed from the others, occupying a position about 15 yards lower in the strata. I append a rough sketch plan of the ground on which these beds are marked Nos. 1, 2, 3, and 4.

"These coal beds dip at a very high angle, with an underlie to the north-east. By repeated and careful examinations with the chronometer I found that the angle of dip varied from 47° to 63°, of course following the inclination of the strata on which these coal beds rest. In the light of a general remark, it may be right to mention that while the strata over a large extent of the surrounding or adjoining country maintain a uniform dip to the north-east, yet at the same time the dip is very irregular over any limited area, while the stratifications are often ill-defined; that convey the idea of their being deposited during or slightly before an age of considerable local disturbance, and this of itself is sufficient to account for the faulty, irregular, and patchy character of these local beds. I have remarked that these beds had by local effort been exposed along the east flank of a low ridge to the south of the Thapan *choung*, and I append to sketch plan a rough section of the disposition of the coal seams as proved by the "costeening" work carried out under my eye and direction.

"To the north of the *choung*, one of these beds has been exposed in a small hole dug at the root of a clump of bamboos. By carrying out a long and deep cross-cut at this place, I first demonstrated the continuity of Nos. 2, 3, and 4 beds, and perhaps No. 1 to the *north* of the *choung*. Stretching further along the line of outcrop to the north two other cross-cuts were begun; and by these the peculiar and interesting fact was demonstrated that these beds, following almost the *contour* of the surface, dipped both to the east and west of the north ridge, were as it were folded over it; in short, the axis of the ridge may be considered the line of an anti-clinal, from which the strata dip or incline in both directions. To the north and south our prospecting work was stopped by the thickening of the surface clays or alluvial deposits; and I have no doubt that future operations, if directed to this end, would prove the beds dipping both ways, *i. e.*, to east and west on the opposing flanks of the southern ridge.

These coal beds are of irregular thickness that shew that in the course of working many 'wants' ("thinnings out") of the seams would be proved to exist. The carbonaceous matter, as is frequently the case with coal seams of a similar age (which I am strongly inclined to think, notwithstanding the absence of fossil evidence, belong to the nummulitic group or the lower Eocene, or perhaps upper Secondary period), has been irregularly deposited, and in appearance resemble the prolonged 'pockets' or 'lodes' of metalliferous mines (*see* sketch).

The thickness of No. 1 bed is doubtful: where it is exposed on the margin of the *choung*, it is on the very edge of two small 'hitches,' or 'troubles,' or dislocations of the strata (*see a* a sketch), between which the seam varied from 9 inches to 16 inches.

No. 2 bed varies from 12 to 15 inches in some situations: this seam is *impure*, containing stains or streaks of carbonaceous shale disseminated through it. It rests upon a pavement or floor of soft fire-clay. The roof consists, first, of a few inches of impure fire-clay; then 18 inches of reddish 'blaes' or clunch or agrillaceous; shale, and above this (to east) about 4 feet of a light brown shale or impure lignite. I may here remark that all these layers vary much in thickness, as may be seen by comparing section at B with section at D on plan. No. 3 seam rests on top of this shale, and this seam, although of variable thickness, seems best defined and the most persistent of all the seams yet exposed. It is likewise 'faulty,' *i. e.*, continuity broken (*see* plan). It was from this latter seam that the coal heretofore extracted has been obtained. Its thickness varies from 10 inches, as at *a* on plan to 2·2 inches between D and E, and it was at this latter point, where the coal bed is thickest, that the mineral now *en route* for trial or experiment has been wrought. For a few inches next to roof of this bed the seam is impure, and contains perceptibly strains of earthy matter imperfectly carbonised, and as a fuel *worthless*. To the south of east, Nos. 2 and 3 seams approach each other by the thinning out of the divisional strata, and to all appearance they will coalesce in course of a very short distance. This is the character of many irregular or wandering coal seams.

"The roof of No. 3 seam is composed of friable or soft black blaes or argillaceous shale that falls on exposure to the weather.

"Separated from No. 3 seam by about 7 feet of this shale, No. 4 seam was exposed in a cross-cut at E, and varies from 13 inches to 15 inches in thickness.

"From the foregoing details, you will have noted that, following the 'lie' or inclination of the subjacent strata, these coal beds rest at a high angle with the horizon; in short, that they are very steep coal seams. This disposition limits to a very serious extent the area of coals for extraction. I fear that no prudent manager would risk working these seams below the level of adit driven from a convenient point on the adjoining *choung*. Should these, however, be wrought below this level, provision would require to be made for pumping or otherwise freeing the workings of the accumulations or growth of water that would be certain to be found during the rainy season at least; and I have serious apprehensions whether it would be possible to work the mines at all with feeders of water to contend with. In this aspect or view the area which it would be possible to work the coal seams would be measured by the height of the surface above the level of such an adit at any given point. The roof of all the seams is soft, friable, and jointy, and may in the actual course of working prove treacherous or dangerous to the workers. I very much doubt whether in a horizontal or flat seam this character of the roof would not have opposed an insuperable barrier to the successful working; but in seams lying as these do at a high angle, approaching in parts the perpendicular; the weight that is generally supported on timber, on, packwalls in the case of flat seams in a large measure (and this exactly in proportion to the inclination) supported by the roof itself. I hope that this is obvious, so that, so far as the roof is concerned, the seams are workable, and the workings should be moderately safe.

"I have mentioned that the coal seams are of irregular thickness, 'thinning' out and expanding, and at times disappearing, in a most capricious manner; further, that the coal beds are likely to be found much; cut up' (the continuity broken) or interrupted by 'wants,' 'faults;' or dislocation of the natural strata. These are all characters that will operate very materially against the successful working of the coal seams; while I much doubt whether more than two of the seams could be mined to profit on account of their thinness.

"In physical appearance, the coal has a hard and lustrous appearance does not soil the fingers · held against the light it has a slightly brown, colour or shade, and separates from the mass in small cubes, which again are easily reduced to smaller cubes by exposure to the atmosphere, friction, or handling. When narrowly inspected, it appears to consist of innumerable little squares, divided from one another by their almost imperceptible lines of white deposits of earthy salts; known in Scotch mining districts by the term "*acamo*." This is a very bad feature in any coal seam, and particularly so when it forms, as in these, a distinguishing feature of the bed. The effect of this will be that, when exposed to the influence of the weather, it will absorb water or moisture, in course of time heat will be generated, and the unequal expansion of the coal and these adventitious layers will cause it to disintegrate and fall to pieces rapidly; this will also interfere or prevent handling or transhipment without entailing a sad loss from breakage; and this alone will prevent it being introduced into any market where British coal can be obtained.

"Irrespective of this, and taking the whole thickness of the seams into account (not selecting a few choice specimens as a basis), I am clearly of opinion that the quality of the coal is not sufficiently good to enable it to be sold, or to compete in any market or manufactory where its results can be compared with the ordinary British coal. In my opinion, it will bear a most unfavourable comparison with the Clyde ports or Frith of Forth (Scotch) coals, which are without doubt the most inferior of all the British coals extensively shipped; its friability will operate against its being used as a steam coal, while I am certain this will be increased by the quantity of ash that it is likely to contain. These remarks are based entirely on the physical appearance and the burning of a very small quantity; and judging the seams as a whole, these coals are not adapted for smithy or cooking purposes. These remarks answer I think, two of three points to which you directed my attention to be given, and on which you desired information in your letter of 25th June, No. 22-23, 'as to the probable extent to which coal may be obtained, and as to its approximate value for producing heat as compared with other well known coal.'

"With respect to the third point to which you direct my attention, *viz.*, "as to the facility or cost at which it can be placed on the surface for carriage." This is the most difficulty problem to solve in connection with this subject. In the beginning, difficulty presents itself in the inaptitude, perhaps unwillingness of the natives (Burmese) to engage in mining pursuits. Should however this last difficulty be disposed of, then it will be found that the natives have by laborious endeavours to be broken from their traditional rude, loose, and unsystematic habits of working, and learn to work regularly, patiently, and after a perfect system: this involves a considerable amount of European supervision, which is far too expensive a commodity to be thought of in the circumstances. At home, by British miners, these seams could be put in hand in the present low state of wages for the sum of 4*s.* 6*d.* to 5*s.* per ton. Coal however is now extensively mined on the Ganges, and at several places in Central India; and in these as well as in other districts east of the Malacca Straits with which I am acquainted, the great difficulty and expense was experienced at the first opening to overcome the prejudices or religious scruples or fear of the natives, and in the second in instructing them by miners of a contingent of European miners introduced for this purpose, I think however that were the necessity ever arising, a sufficient number of Indian or Chinese miners could be introduced at a comparatively small cost, who would be capable of instructing the Burmese in the art of coal-mining. Without any desire that my remarks may be too critically examined or considered as arbitrary, all ignorant as I am of Burmese character, &c., I am of opinion that these coal seams could, after a reasonable time, be produced or put on banks for a sum varying from Rs 3 to Rs. 3-8-0 per ton of 20 cubic feet by native labour. As there is no local demand or consumption for coal, all the produce must by necessity be transported to the market on the Irrawaddy. This to my mind presents an almost unsurmountable difficulty."

The Planters' Gazette.

TEA.

THE RED SPIDER, ITS CAUSE AND EFFECTS. HEAVY *VERSUS* LIGHT PRUNING.

A CORRESPONDENT who has had experience, in Assam, writes to the *Ceylon Observer* as follows:—

When one reads the different complaints made by planters in the Neilgherries and other places in which tea is grown, of the visits of the red spider and its destructive effects on tea plants, we in Ceylon inwardly bless our stars that we have nothing in that way to complain of here in our new and hopeful tea gardens, the cultivation of which is yearly being largely extended all over the island. Yes, proprietors of estates in India who have lost large sums of money in coffee by periodical visits of different enemies, such as borers, grub, foot rot, leaf disease, &c., and who are turning their last penny to tea cultivation, must indeed think it hard lines to be check-mated by an insect like the red spider and see their crop year by year blighting, and to think, that like leaf disease there is no cure! They have themselves to blame. I do not hold to a planter going by what his neighbour does in the cultivation of coffee and tea: he must use his own judgment and try and better what his brother planters have failed in. Planters as a rule say: "So-and-so does it and being an authority we must do the same." No such thing. As a proprietor or a superintendent in full charge, I say use your own discretion in exempting; and if not on a large scale, do so experimentally on a small one, and if successful, you have your point won. Planters in the Neilgherries as well as in different other tea-growing districts of India invariably, hold that heavy pruning throws back the coming years crop. A greater mistake could not be imagined. They little know the injury they are suffering year by year, that they allow their trees to *bush up*. I have studied and have made it a study in different tea districts of India, and have pruned trees heavily and lightly (or what is called a *surface* pruning) and have noticed the effects of both. A tree pruned heavily or with the heart cut out, cup shape—not only gives a heavy first flush but continues doing so month by month. For pruning the plants cup shape I do not hold to simply cutting out the centre; no, you must use judgment and remove as much useless wood all round as to allow a certain amount of light and air to pass through the plant. By doing so you not only give the tree fresh vigour but give it a chance of recovering any shocks which it may be liable to form drought or any other similar cause. In pruning the estate always choose a time when the moon is on the decline, as, at such times, the sap is throwing out fresh roots and you do not bleed the trees. Cup shaped pruning again to a great extent prevents seeding which draws away a certain quantity of sap from the flushes and gives weak liquor, in testing the teas, as most teas do towards the close of a season. Taking the other style of pruning or what is called surface or flat cutting, I will give the results I have met with at different times. In pruning the surface you remove little or nothing beyond young word such as the plant has gained within the last few months before close of the season. Can any sensible man tell me the good that will result from this? No you may as well give the trees a bad or careless picking.

I have found the trees flush heavily at first and gradually harden at every fall of rain and the natural effect is that you lose the crop! Again where are the light and air that you used to pass through the trees? Echo can only answer where! The bush is clogged up with not only useless wood but *decayed leaves* and *filth*. Now for the great point and final result complained of by planters and the topic of my writing you, comes a blight in the shape of the *red spider* which spreads from tree to tree. In Assam and in different parts of the tea districts of India where tea cultivation is largely carried on, planters do not prune heavily every year, but once perhaps in three years or more and in the meanwhile surface prune. Pity people will be so stubborn and not take advice where experience is dearly bought. I say prune heavily every year and there will be very little cause of complaint about *blight and red spider*. I do not give this as a reproach on what others are doing but as facts that I have met with it and it will indeed be a crying shame, if in a young tea district like Ceylon where tea prospects are so largely extending we catch the infection and have further causes of complaint that our brother planters are having in coffee, by simply following the bad example of our sister country, India.

KANGRA VALLEY.

September 19.

THERE are signs that the tea season is drawing to a close, as week by week the bushes yield shorter and harder leaf. Two or three slight falls of snow have cleared the grimy face of the Upper Range, while the grass under the benign influence of a hot sun is beginning to get sere and brown, and we shall soon be indulging in that mongrel occupation which passes under the name of hay-making with us. The grass is cut here by daily labourers who are paid in salt, the black salt that comes from Mundi; and when it comes to distributing it to 200 or 300 hands at the rate of two seers each every evening, it is almost as invigorating as a sea bath. The harvest this year is a wonderfully good one: bumper crops of both rice and Indian corn.

IN THE NEILGHERRIES.

It has been alleged by some enthusiastic speculators in tea-culture in Southern India, that the cultivation of that plant will, in a few years, supersede that of coffee. We are not disposed to go to such lengths in stating our views on the subject of Indian tea-culture, for coffee is destined to hold its own in districts suited to its cultivation. But the future of tea culture in Southern India is a bright one, and the slopes of Coonoor Ootacamund and Kotagherry will, we have no doubt, before many years, be clothed with tea bushes. Already there is a perceptible increase in the extent of tea cultivation on the Neilgherries. The writer of this article on a visit to Coonoor last December, after an absence of five years, was struck by the marked increase in the number of tea-gardens in the neighbourhood of that hill station. We have already said that Neilgherry tea has won a reputation in the Home markets exceeding that of Assam growth and manufacture. So successful, indeed, has Neilgherry tea proved in England that offers have been received by planters for their produce at half a-crown per lb., free on board, at Madras. Various reasons have been assigned for the high reputation enjoyed by Neilgherry tea, but the real secret lies in the fact probably, of the mode of manipulation of the leaf employed by the Neilgherrie planters. In Assam the leaf is "fired" immediately after it has undergone the process of rolling. The Assam process, doubtless, retains the full strength of the leaf, but the delicate aroma is dispelled. The Neilgherry process is to remove the leaf from the rolling tables to mats in which it is spread in thin layers, and left all night in a room of moderate temperature. A certain proportion of strength may be thus lost, but the delicate aroma for which Neilgherry tea is appreciated, is secured Tea drinkers in England and on the Continent dislike Assam tea unless mixed with China, the former being too strong for consumption.

There is one advantage, certainly, which tea-culture possesses over coffee. Tea can be grown as well on *grass* as well as on forest land. Mr. Elliott observes "that the fact that tea can be grown on grass land at all, at once places the plant on a footing which gives it immense advantage over coffee, which can only be grown within certain narrow limits as regards climate and elevation, and which absolutely requires the finest forest land to grow the tree in anything like a paying form." It is a mistake, however to suppose that the tea plant does not stand in want of manure. There can be no doubt that manure, though slow in showing its effect on the plant, increases its yield considerably, and combined with judicious pruning and picking will give a yield, it has been proved, exceeding the most sanguine expectations of the planter.

In Assam, tea is cultivated on forest land. The low jungle is cut and burnt, and the larger trees are rung, and eventually die away. The great disadvantage in cultivating tea on forest land is that the plant is liable to the attacks of its enemy, the white ant. Great damage was done to some tea-gardens in Coonoor, a few years ago, which had been opened on forest land. The white ants got at the plants, and it was a difficult and trying task to clear the enemy away.

A suggestion was made some six years ago by the *Indian Economist* with reference to testing the relative merits of the Neilgherry and Assam processes of tea manufacture, which is worth repeating here. It is as follows:—"The question whether delicacy is due to altititude alone, and not to manufacture, might be ascertained by experiment. Let a quantity of green leaf be sent down from one of the Neilgherry gardens, worked up at the foot of the hills, an equal quantity sent up from one of the Assam gardens, say to Shillong, and manufactured on the Neilgherry principles there, and the results then compared. This experiment would cost little, and determine a not unimportant question, for all engaged in tea are interested in using their best endeavours to fit it for public consumption, and to guard it against China in any shape or form whatever." We are not aware whether the experiments has ever been made, and if it has not, it certainly deserves a trial.—*Madras Times.*

DARJEELING TEAS.

It must be exceeding gratifying to producers to find their teas selling so well in the Calcutta market at the present time, notwithstanding the very discouraging results of the first sales of the season. This year (as far as the Darjeeling district is concerned) there has been a marked improvement in the quality of tea manufactured over last season, and this in spite of unfavourable weather. So far, the all round quality of the tea manufactured has been an improvement in every way on that of last year, and there has been a larger proportion of fine class tea compared with medium and broken, sent down to Calcutta from the factories. This good result is of course due in a very great measure to more attention being paid to tea house work pure and simple, but it may be (and possibly is) also attributable to a slow but sure revolution in the whole system of working tea gardens, and which revolution began about 1874 or 1875. In the "good old days" of tea before the crisis, the man who spent most money on his garden, and had the least results to show for it at the end of the season, was popularly considered the best planter, and the man who spent from Rs. 60 to Rs. 80 in manufacturing a maund of tea was applauded, and to shew how his services were appreciated his pay was increased. The crisis shewed that this was a mistake. Before the crisis people were well satisfied if they made one or at the outside two maunds of tea per acre of mature plant, and in those days fancy prices were realised for Darjeeling teas. Then came the crisis, and an entirely new system began. It was laid down as an axiom that it was impossible to kill the tea plant, and the more it was plucked and bullied generally the better the bush liked it and the more it throve. These were the times when one planter meeting another asked.—"How much tea have you made?" when the man who had turned out less per acre up to date than his interlocutor felt humiliated in his own eyes and those of his neighbours, and he went back to his garden and pulled what little life remained in his bushes off them. These were the times when people believed in making six or seven maunds of tea an acre, when they gave premiums in the shape of pice to their coolies for bringing to the factories any quantity of leaf over a fixed minimum; utterly regardless of the quality of the leaf, and of fact that they were paying a very handsome premium for "killing the goose who laid the golden eggs." From this epoch dates the appearance of "red spider" "blight" &c. &c., amongst the hill gardens. Quantity was the rule in those days, every one seemed fired with the laudable ambition of making as much tea as he possibly could, and nobody seemed to care what his tea fetched so long as it was sold—even at four annas a pound. This paid very well for a season or two; but then came another revolution. The market was simply flooded with low class teas and it was hard to sell them even at a loss. At the same time it was found by practical men that the bushes were being simply killed by light pruning and heavy plucking and that unless another revolution took place Indian tea must collapse altogether. Simply because while the market was being glutted with low class teas the bushes were becoming small by degrees and beautifully less, and the prices realised for the crop were falling steadily year by year. This necessitated a complete change of system which may be looked on as having begun in 1876. Formerly it was considered that the main crop of the season should be gathered not later than the middle of June, and to do this it was necessary to pluck every (or nearly every) new shoot off the bush as soon as it made its appearance. This system of course prevented the bushes from making any new wood to speak of, and the natural result was the deterioration of both the trees and the leaf taken from them. Finding that though this plan paid very well for two years but resulted in loss if persevered in for three or four consecutive seasons, what may be denominated the modern system was inaugurated. This consists in letting the first flush run until the young shoots have attained a length of from six to eight inches and then plucking off only three top leaves. This has resulted in a smaller quantity of tea being manufactured at the beginning of the season compared with the old systems of working, but it has also resulted in greater quantities of better tea being made later on, and in leaving the bushes strong and healthy for the next year's operations. This new system is evidently the right one, as it allows of a fair average quantity of good tea being manufactured, without deteriorating the producing power of the bushes.—*Darjeeling News.*

COFFEE.

We regret to learn from the Neilgherries that leaf-disease has lately appeared on some of the estates, situated in the neighbourhood of Kulhutty. One property has put on an unmistakeably rusty appearance, and the disease is spreading. Whether the extremely dry season that was experienced in the early part of the year, or the continuous wet weather that succeeded the drought, or the one followed by the other is responsible for the disease, is hard to say.

As it seems likely that copious applications of sulphur may be useful as an alleviative to leaf-disease, the following notice of a new field of supply will be intesting to planters. Efforts have recently been made to utilise the wealth of crude sulphur at White Island. This island is an active volcano, situated in the Bay of Plenty, and contains a superfical area of some 60 acres. The sulphur is present in very large quantities and is pure and of good quality. A tramway is now being laid in the crater, and two wharves are in progress for the accommodation of shipping.

A CORRESPONDENT in the Shevaroys writes:—"Leaf-disease is spreading, but coming so late in the season no injury is likely to arise to crops now maturing on the trees. The wise will nevertheless adopt immediate measures to arrest the progress of the disease and nip it in the bud. About a year ago I mentioned that an attempt was being made to naturalise Liberian coffee on these Hills. On a recent inspection of the place selected for the experiment, I found the plants, about a dozen in number, looking vigorous and healthy (with one exception, which had fallen a prey to leaf disease) and from 12 to 18 inches high. The experiment having proved so far successful a number of planters have combined to procure seed from Liberia direct with a view to cultivation on a larger scale. I hope to be able to say something more on this subject by and by."

A GREAT deal of attention has been drawn to Liberia since the discovery that its gigantic coffee tree will grow readily in most of the coffee-producing countries of the world, and at an elevation much lower than the Arabian and other species. It will be seen in our columns that the Sarawak Government has just imported a specimen case as an experiment, and from information we have gleaned from a recent work published in Ceylon (where the plant has excited considerable interest amongst the planters, many of whom are opening up estates on a large scale) styled Liberian coffee, its history and cultivation, there is every reason to think that the introduction of the plant in this country will be attended with marked success.—*Sarawak Gazette, August*, 31.

THE *Ceylon Observer says* :—We have met two gentlemen from Dimbula who agree that, notwithstanding one of the most virulent and widespread attacks of leaf-disease within the past few months to which the coffee trees have ever been subjected, the prospects for crop in season 1878-79 are most encouraging. There is abundance of wood and abundance of leafage is coming in the shape of fresh and luxuriant flushes. Two estates have been mentioned to us as special examples of the good effect of early and copious manuring. Holyrood is an expanse of about 800 acres of coffee. A short time ago it was a scene of desolation, and it really seemed as if fields would absolutely go out. Now it is covered with a mantle of the most luxuriant green leafage. The same is the history of Kotagaloya. All over the great valley or series of valleys, even one estates which were not manured, there is a fine flush of leaves, and the promise for "next year" is exceedingly good. To shew the confidence retained in coffee we may add that for Palmerston Estate, Dimbula, consisting of 200 acres coffee in full bearing and 12 reserve forests, Rs. 220,000 has just been offered. This is considerably over £100 an acre for the coffee.

THE following particulars of the auction sale of Liberian coffee berries at Buitenzorg on the 21st August are translated from the Sourabaya *Courant* :—

"In packages of 10 berries the coffee was sold for 8·50 to 24 (average 12) guilders per package. 5,080 berries have been sold for about 7,240 guilders. During the auction it was jokingly remarked that, for the present, the Government had nothing to complain of respecting the coffee prices, for that sale of berries could be considered as having been made at the rate of 700,000 guilders per picul. In the cultivation garden 414 coffee plants are now on available land, 118 of them having been imported from Liberia. Almost all of the latter are bearing fruit. Amongst them are trees which possess 700 to 800 berries. The remaining trees have been raised in the garden itself from cuttings, 300 of which have already taken root. I have also seen a thousand young plants (cuttings) in the nurseries and 300 other plants raised from Java grown seeds. The trees are planted at a distance of 12 feet from each other, so that there can be 500 trees in an area of one bouw. The present or first crop has yielded about 25,000 berries of which only one-fourth has been sold. The remaining berries will be dealt with by the Director of Inland administration in concert with the Director of the State Botanical Garden. They will be forwarded to different provinces in order to be planted out there under the supervision of the authorities."

PLANTING NOTES FROM CEYLON.

Central Province, 30th September. 1878.

ON most estates picking has now begun, but it will be October before we are in full swing, if the present style of crop deserves to be called full swing. The usual preparations have been made ; stores put in order ; barbacues repaired and made to glisten with a new coat of tar ; pulpers re-covered, and re-set, just as in the olden times which we now "remember with a sigh. All this expenditure of effort, however, in the face of a small crop, is ludicrously like ringing the dinner bell with only a herring on the table. Even if we were to get all that is on the trees it would not be so bad, but already the coffee has blackened at the points of the branches to a distressingly large extent, and it is a question whether much of it is really worth the trouble of taking in at all.

We heard cheery news the other day that a small insect had been discovered in some of the higher districts, feeding on the coffee fungus, and that in time the pest would be altogether "chawed up" by it. But while we were blessing this new ally and praying for its long life and greater increase, one of the scientific authorities in Colombo, to whom a specimen had been sent, dispelled our dream by holding out little hope that the expectations raised would ever be realized, for he held that the insect would require to multiply to a marvellous extent before it would make any impression on the *Hemileia vastatrix.* I hoped it was multiplying, and went to search for it in the yellowest dusted leaves I could find, and carefully scrutinized leaf after leaf, by the aid of a powerful microscope, but without any success. There was no living thing that I could see revelling in the golden harvest, and instead of a new friend and ally, there was only the old enemy holding its own as viciously and vigorously as ever. I fancy the insect may come this way by and bye, and if it does it won't starve, much more likely to die of repletion. As if the horrors of leaf-disease were not bad enough, I hear that in the Matale district an added horror has appeared in the shape of red fungus on the berries when they are about half ripe. What this means or what it will result in, remains yet to be seen.

Of the efforts being made to check leaf-disease, it is said that in Uda Pussilava, one planter has sprinkled several fields with sulphur, at a cost of about Rs. 10 an acre, and the cure has worked like a charm. I hope that the news is not too good to be true, for so many paper cures have gone up in public estimation just to come down again that one's faith gets weakened and one's unbelief strong. Ere very long coffee will have got a taste of almost everything, and I hope that it will yet repay all the care that is being bestowed on it. Liberian coffee still gets considerable attention, and the growth of the plant is simply amazing. I saw some of this coffee lately, planted—the seed I mean,—only seventeen months ago, and it was five feet high, and looked vigorous and strong Estates are now being opened in various parts of the low country, but the land about Polgawella Station, near which two estates are now opened, is much better than either Caltura or Galle. The land at Galle is miserably poor and Caltura has some bare ridges on which cinnamon and cocoanuts are being planted, while the richer portions are devoted to the African coffee. The richness of the land in any of the places is not, however, a thing to be bragged about, for Ceylon, as a rule, is not famous for its fertile soils, and we incline to give greater thanks for little than a more favored place would ever think of doing. One of the Liberian estates opened had all the coffee planted under shade but it has been found that while the plants are all the better of a little cover at the outset, if removed in time, it tends to make the plants tall and straggly. Estates are now being planted that have been completely cleared, and are doing very well. The young Liberian plant takes somewhat unkindly to transplanting, remaining inactive for a time, but once it does make up its mind to grow, and its roots strike out into the ground its progress is simply marvellous. There is one advantage in connection with this coffee, that, unlike the Arabian variety, the grower of it has a better chance of regular crops, as it does not depend on any particular season for blossoming, but goes on month after month while the fruit is on the tree in every stage. As to what Liberian coffee will yet bear, the results I doubt not will be handsome enough, if the average at all comes up to the trees which have already fruited, for on some plants only three years old and which had no special attention paid them, an estimate of 11 cwts. an acre has been made. Like the Arabian coffee it is subject to leaf-disease, and here I have found the testimony regarding the effects produced very conflicting. Those who ought to know say that except making holes in the leaves the disease does not otherwise affect the plant—neither do they drop off as in the other coffee. Equally good authorities maintain that the leaves do drop off, and, what is more, and if true rather serious, that the effects of a strong dose of leaf-disease is such that the berries never fill. Outside they look well enough, but they are light and worthless. I can hardly fancy that this can be correct, for there are thousands of plants now growing in the island which have been raised from native seed, the plants on which they ripened having been more or less tainted with the pest. Those who have been early in the field in this enterprise cannot fail to do well if the cultivation is to extend, and there seems every prospect, for innumerable plants will be wanted, and although the price were to fall from the present, a shilling each, to as low as a farthing, a first crop sown for sale would realize a splendid profit.

I hear that Mr. Montclar, besides having several old estates to work upon, has got the promise of a part of a new clearing about Badulla on which to experiment with his new system. He is unfortunate being here [illegible] his particular season of the year, for most planters' heads are full of crop and curing, and they have few ideas to spare for "fluid electric," "rain gauges," "endosmose," "exosmose," "humus," and the other paraphernalia with which our eccentric and learned visitor makes his darkness appear as a light about him.
—*Madras Times.*

LEAF DISEASE.

CEYLON Chamber of Commerce, September 6, Mr. George Wall in the Chair.

The Chairman, previous to moving the first resolution, read the following letter from the Manager of the Ceylon Company addressed to him by that gentleman :—

Ceylon Company, Limited,
Colombo, 5th September, 1878.

The Chairman, Chamber of Commerce, Colombo.

DEAR SIR,—I regret that I cannot be present at the meeting on Friday to support No. 517, which I observe is to be brought before the meeting by yourself and Mr. Duncan.

The importance of not only deprecating but of authoritatively contradicting such statements as have lately been made by pure theorists on the subject of coffee leaf-disease cannot be overrated, calculated as they are to shake the confidence of capitalists at home in the soundness of the coffee enterprise. Representing as I do large interests in various districts, I cannot but admit the serious nature of the disease with which the coffee planter has of late years had to cope; but I am also able fully to endorse the statement of the Chamber that in no case have I been able to verify a single instance of a coffee plant having been killed by hemileia vastatrix *alone*. I have my own theories about the origin of this disease; and I cannot but think that it would be found to be traceable to a system of cultivation, which, through successive generations from a common parent stock, and without any mixture, so to speak, of fresh blood, in and in breeding, in fact, has until late years at all events, been directed to the one subject of *increase* of *yield*, totally irrespective of improvement of stamina, and of the varying conditions as to soil and climate under which that cultivation has taken place. I believe also that planters in one way or another are beginning to recognise this fact; and that more attention is now-a-days being paid to the scientific application of manures, than has ever been done hitherto; and that in this combination of scientific and practical farming will be found the best antidote for the evils of hemileia vastatrix and other coffee pests. In my opinion, therefore, the notion is to be ridiculed, that the coffee enterprise is likely to be brought to an end (!) by the agency of the hemileia.

I am dear, Sir, yours faithfully,
C. W. HORSFALL,
Manager.

The Chairman said they had frequently heard during the last few years statements of a very damaging character, made by eminent scientist at home, but as these statements had not reached Ceylon until some weeks after they were made, it had not been deemed advisable to refute them. He had no doubt his hearers, like himself had wished they had been on the spot to contradict or to correct them at the time. Latterly, however, it had been stated by a very high scientific authority that leaf-disease had practically put an end to coffee planting in Ceylon; and as this was opposed to the facts of our knowledge and experience it became the duty of the Chamber in the interests of the large body of capitalists who were concerned in the coffee enterprise, to give it some authoritative refutation. The time had come in fact when the truth must be made known but it must be the whole truth and nothing but the truth. The truth, then, was that leaf disease had undoubtedly done and was still doing very serious mischief but in making this admission they were bound to remember that the pest had been in full force for over seven years; and during that time most estates had suffered repeated attacks of the most malignant form of the disease. It had had full scope and had done its worst, and what was the consequence? That although the plantations had suffered some reduction in the amount of their crops, they had in every case fully recovered, and become as vigorous and as luxuriant as they were ever known to be. They had successfully resisted these repeated attacks, and had subsequently produced good crops of unimpaired quality. Here, then, was the whole truth; and the statement that the leaf-disease had extinguished, or brought to a practical end, the cultivation of coffee in Ceylon, formed no part of the truth, but was directly opposed to the facts. Associated with the statement in question, and in support of it, the eminent scientist who had given it publicity, had made another statement which, although not mentioned in the resolution, could not be passed over. It was to the effect that the coffee destroyed by leaf-disease was being replaced by other products, such as cinchona tea, &c., &c. In this supposed institution of other products was an apparent confirmation of the other allegation as to the extinction or coffee. It therefore behoved us to consider what was the truth as regards the introduction of the new products in question. The fact, well known to all then present, was that tea, cacao, and cinchona were introduced long before the appearance of leaf-disease, but as they were only on an experimental scale, they did not attract attention till a later date. The success of these experiments showed that a mistake had been made in the planting of vast areas of land of various soils and aspects, indiscriminately with one single product; and it became evident that in some situations, the new products succeeded much better than coffee. Hence the gradual introduction of a systematic cultivation, not of coffee only, but of such other tropical products as best suited the soil. It was not because coffee was extinguished, but because more suitable use was found for portions of our estates, that new products were being introduced; morever the high price land had lately maintained had caused people to consider whether it would not be better to utilize the lands they had, rather than buy new land at a high price, and probably in remote districts. The tendency of leaf-disease had, no doubt, been to give additional encouragement to the introduction of new products, but it would not be true to say that the planters had been driven to them in consequence, as alleged of the destruction of their coffee by leaf-disease. He (the Chairman) considered that coffee suffered only the common lot of every other produce of the soil, in having its particular enemy. It was not remarkable that coffee should suffer from leaf-disease, any more than that wheat should be subject to smut, rye to ergot, the vine to oidinu, or potato to rot; but it was matter of congratulation that, whereas some of these diseases injured the fruit, leaf-disease affected only the tree, and left the fruit, unimpaired in quality. He spoke from an experience of over 30 years as a coffee-curer and estate-visitor, and could confidently affirm that the quality of Ceylon coffee was now as good as it had ever been. There were perhaps instances where young managers had not given quite so much attention as the older hands used to do to the treatment of their crops on the estates; but the produce, on the whole, maintained its high character. They had very strong proof of this in the high prices commanded by Ceylon plantation coffee as compared with the coffee of other countries not affected by leaf-disease. Never, he affirmed, was the superior character of Ceylon coffee more clearly marked than it is now by the wide difference in the market values. So far, therefore, as that part of his motion was concerned which referred to the quality of our plantation coffee, he considered his case was established (hear, hear.) It was marvellous to him that men in the high position occupied by those scientists who had pronounced the doom of coffee, should have ventured on such statements in face of the fact that any other agricultural product was subject to the like, or to worse diseases. As truly might they have declared of the potato, or of the vine that its cultivation was practically at an end, as of coffee in Ceylon. He was aware that gentlemen present could adduce instances in proof of the power of coffee to withstand leaf-disease, but he would cite just one instance, not remarkable in itself, but which was then very fresh in his memory. In February, 1876, in company with a friend from London, he visited a group of fine estates in Matale. On arriving there, to his dismay he found them suffering from one of the worst attacks of leaf-disease he had ever witnessed. They were, in fact, almost leafless from end to end, a picture of desolation. The prospect of crop seemed to be wholly gone. Yet, in March and April good blossoms came, and good crops followed. The mark of these estates was one well-known in the market, and was in high favour, and the quality of the crop produced immediately after that virulent attack of leaf-disease, maintained its high character unimpaired, and commanded the highest prices of the day. That was not an isolated case, but it was one of many proofs that might be adduced to demonstrate the ability of Ceylon estates to resist attacks of hemileia, and produce crop of the best quality immediately afterwards. He moved the resolution in what he believed was the discharge of a duty the Chamber owed not to itself only, but to a very large number of persons who had invested capital, and were largely interested in the coffee enterprise of the island, (applause.) The resolution was as follows :—

"The attention of the Chamber having been called to certain statements which have been lately published in England by distinguished scientist to the effect that 'leaf-disease' has practically brought the cultivation of coffee in Ceylon to an end, the Chamber regards it as a duty to deprecate such statements as being opposed to the facts of our knowledge and experience, and calculated to excite undue alarm in the minds of persons, especially absentees interested in coffee cultivation.

"The Chamber can vouch for the fact that coffee plantations which have suffered repeated virulent attacks of hemileia have recovered completely, and have since produced large crops of unimpaired quality. The Chamber has not been able to verify a single instance of coffee trees having been killed by the agency of this pest. It is fully admitted that serious injury has been inflicted on Ceylon coffee plantations by the attacks of hemileia, but the rise in the market value of the produce has almost counterbalanced the deficiency of the yield, and the Chamber feels assured by the experience of the last seven years that the coffee enterprise in Ceylon still rests on a sound basis, and is in no danger of being 'brought to an end' by the agency of the hemileia."

Mr. Duncan, in seconding the motion, thought that it was unnecessary for him to make any addition to the exhaustive remarks of the Chairman but he might be permitted to place before them a few facts with reference to the results of leaf-disease on certain estates that had come under his own notice. He had been looking through the records of those estates for some years past, and he was glad to be able to say that the largest crops were produced in 1876-77—five years after leaf-disease commenced in Ceylon (hear, hear.) He purposely turned his attention to the estates that had not been in any way extended, and he might say that leaf-disease had not prevented any of them from bearing large crops; indeed, in favourable seasons some of them had borne more than before. A great deal of attention had been devoted to this subject of leaf-disease, and he was afraid that they had almost forgotten the extraordinary changes of the season that had occurred of late years. It was a most singular fact that for the last seven or eight years they had had, comparatively speaking, very dry crop months. In one district no crop was cured at one time without the hot air apparatus, but they could now go through that district and not see one of them in use. Then they were aware that during the years when they had had very short crops they had been either troubled with abnormal rains or excessive drought, and in a great measure short crops could be attributed to those causes more than to leaf-disease. At the same time he did not mean to say that damage had not been done by leaf-disease; still, he thought that ample proof was afforded by the records of the different estates that they were able to stand against it, and that there was no danger at present of estates being snuffed out by it (hear, hear).

The motion was unanimously carried.

The following abstract of Mr. Abbay's paper has been forwarded by Mr. Murie.

Coffee Leaf Disease.—At the meeting of the Linnean Society on June 6 last, the Rev. R. Abbay read a paper on the above subject. His chief object was to lay before this scientific body his investigations into the microscopic structure and germination of *Hemeila vastatrix*, the fungus in question. He also in passing gave some general remarks on its history, a general description of the plant and the conditions of growth, &c. Dealing with the minute structure he shows that the orange red sporanges of the fungus occupy chiefly the stomata of the leaves. Closer examination reveals dark saclike bodies from which branching mycelium containing within the thread reddish brown granular matter, ramifies amongst the cells of the leaf. The spores again differ much in size and figure, their average size being one inch in diameter, smooth-surfaced or roughened as the case may be, but with moisture swelling considerably. Experimenting with dry leaves obtained from Ceylon in 1877, he only managed to get a small quantity to germinate, but sufficient to trace out the general process of growth. He has observed, however, certain minute differences between the Ceylon and Sumatran forms of *H. vastatrix*, though, as a whole, they are uncommonly similar. As to the conditions of growth his attempts to infect coffee plants have not hitherto been successful.

The conoidial form of germination can readily be grown on the outside of the leaf in a moist atmosphere, but it does not appear to penetrate within the leaf tissue nor beget clusters of red sporanges outside it. This latter form is the common one in which the "disease" is recognised in Ceylon, and it may be said to be the dry weather form of the fruit, appearing as it does immediately after the rains have ceased and but very rarely during their prevalence. In certain districts in Ceylon a strong wind has been observed to have great effect in carrying the "disease" hither and thither; and by thus spreading it points to the conveyance of the "disease" to the trees through the stomates of the les and not through the roots, as some have supposed. Mr. Abbay suggests, therefore, that to moderate the virulence of the pest—all the proprietors of a district should combine to gather and burn at the commencement of the chief annual attack all the diseased leaves and twigs, that at present are allowed to lie on the ground beneath the trees until they decay. By this means a vast number of the spores would be destroyed which otherwise might float about and propagate the disease. Doubtless such a plan would tend to moderate the spread of the disease, and especially if combined the plan already occasionally in use, *viz.*, the sprinkling of quicklime beneath the trees—by this means destroying the spores and, therefore, liability to spread the infection. But that these remedies should be effectual, it would be essential that most or all the planters of a district, should unite, and about the same time carry into effect their burning and quicklime measures.

It has been stated that native or uncultivated coffee as well as the Liberian coffee are exempt from the disease, a statement not based on facts, both being liable to the fungoid ravages. In allusion to this scourge and its disastrous effects commercially, he mentions that for the five years preceding and including 1871, the average yield of coffee over the whole island had been 4·6 cwts. per acre, whilst for the five years succeeding 1871, the average has only been 2·9 cwts. Since its introduction in 1869, it is estimated that £12,000,000 to £15,000,000 have been lost in crops alone. As at first the pest seemed to disappear for a time, hopes were raised that it was but a temporary mischief and especially as no tree ever died, though repeatedly attacked. But nevertheless that the vegetation, vigour and yield of berry has been seriously impaired is now beyond question. Ample manuring has, in some instances, succeeded for a time, but ultimately the stimulus has lost its effect. The vitality of the spores of the fungus is quite remarkable and apparently places no limit to the distance they may be conveyed alive; for, eighteen months after their transmission from Sumatra through Ceylon to England, in the middle of winter, they have been found to germinate freely. Unless the precautionary measures above stated, no absolutely certain remedy is at present known.

(Signed) J. MURIE.

THE LIBERIAN PLANT IN CEYLON.

A CORRESPONDENT of the *Ceylon Times* writes:—I was one of those few who some years ago held to the opinion as I also expressed it in your columns that the time would come when vast tracts of land in the low-country then reckoned of little or no value would be made to yield products of considerable account. You agreed with me at the time, and added the remark that the man who led the way to their cultivation would benefit the people of the low-country, and would be entitled to the lasting gratitude of the country.

Well this way has been shewn by more than the product. The time is coming when the value of our exports of Liberian coffee and cocoa, I am not so sure about tea, will go a long way towards equalling those of all other low-country products.

Of Liberian coffee, there is still a good deal to be learned, but already we know something quite sufficient to guide cultivators in the future. We know that the coffee plant of Liberia will not, as at one time believed, remain proof against the attacks of leaf-disease, but we know that it has the power of throwing it off more rapidly and suffering less from it than the Arabica species. We know that it will grow and flourish at altitudes before thought most unsuitable to it, and only fit for the ordinary coffee plant; but we know that its value lies in growing and producing good crops at altitudes at which the ordinary variety will not produce crops remunerating. We know that the rainfall in Liberia exceeds the ordinary rainfall in many parts of Ceylon, but we know also that the difference in moisture is not actually necessary, the more so that along the south-west coast of Ceylon the vapour held in suspension by the atmosphere is much greater than that of the Liberian climate, hence a compensating influence. We know, or at least, we have been told, that the large crops spoken of as produced in Liberia are the result of soil apparently no better than ours; but we know also that looking at the situation and cost at which the new berry can be grown in Ceylon, we may be well content to gather half the quantity per annum which is spoken of. We know that the period required to produce fruit from blossom, and mature that fruit for gathering from the Liberian coffee tree, extends from nine to eleven months as against six or eight months in the case of the ordinary Arabian variety, but then we know something equally important per contra that new wood of the Liberian variety comes into bearing in five or six months as against six or twelve in the case of the ordinary plant; so that in fact the two processes are merely reversed. We know also, which is an important consideration that once ripened for bearing the Liberian wood goes on producing blossoms from month to month, hence there is as in the case of the cocoanut tree always crop coming on.

We know that Liberian coffee needs for large crops the best of soil and this may not always be found, at any rate, in sufficient depth; but we know also that if the soil be somewhat superficial we have only to make the holes the larger and deeper, filling them with as much surface soil as we can collect, and failing a sufficiency of that, with good soil brought from elsewhere. The ultimate result will amply repay the cost of this care.

We know or believe that Liberian coffee is reported as coarse in flavour: but we know that care in curing and packing has a great influence on the quality of the bean, and so it will be with Ceylon-grown Liberian coffee. This we know, however, is only an impression, for in the American Market were alone these two kinds compete the strength of the Liberian compensates for the higher aroma of the Arabian, and for this quality obtains an equal price with the best of the older kind. We are told the same relation exists between Liberian and Arabian as respectively between Indian and China trees.

LEAF-DISEASE IN BRAZIL.

Fazenda Angelica, S. João do Rio Claro, Brazil,

26th July 1878.

MY DEAR SIR,—About a month ago, while on a visit to the town of Campinas, about 80 miles distant from here, I saw something which made me feel rather uneasy about the Ceylon coffee estates, and I determined to write to you as soon as I got home. On arrival there however I found waiting me an invitation from the Chief of the Cabinet, who is also Minister of Agriculture, for me to attend as representative member at a great Congress of agriculturists, to commence its sittings on 8th July in Rio de Janeiro. I had of course my house to put in order for an absence of at least fifteen days, so had to put off writing to you until the business of this august assembly should be finished. From what I have seen in your paper since my return however, I fear I am too late to avert the visit you have received from *Cemiostoma coffeellum*. A better description could scarcely be given of the effects of this pest on the coffee leaf than that given by Mr. D. Morris in your paper of April 13, in his notes on Liberian coffee, contributed for your forthcoming volume on this new shrub.

My observations made at Campinas have been confirmed by what I have since seen in S. Paulo and Rio de Janeiro; indeed, in every place where Liberian coffee is offered for sale, and that is all over the country at present. "Leaf-disease!" said my friend at Campinas, "why I have had these plants only three days and they have not been much more than a week in this country. They are direct from London!"

"If that's the case," says young Miller of Dully and Miller, merchants, in S. Paulo, "we have made a bad spec, but you are the only one that has noticed it."

In the lobbies of the Congress Chambers in Rio de Janeiro were some cases being exhibited in view of the coffee planters there assembled ordering consignments. The plants had come from Europe in hermetically closed boxes, and were from six to nine inches above the moss in which the roots seemed embedded. The boxes had been newly opened, and only a week had elapsed since their arrival in the country. The exhibitors said these spots were on the plants when the boxes were opened.

Almost every plant had been attacked; in most cases the moths had escaped and was likely in the chrysalis state in the moss beneath. This—as I shall describe further on—would show that it was at least twenty-five to thirty days since the eggs had been deposited on the leaves, and this must have been in Europe. What I noticed particularly, however was that the fungus which generally attacks the leaves during the time the worm is feeding inside or after it has left was entirely absent and the upper skins were curled up and soon a hole would be formed in the leaf where the worm had been eating, and which was now a brown spot.

What I wanted to impress on you and which I fear am too late in doing was that *plants* of Liberian or indeed of any coffee should not be imported, but if the experiment is to be made let it be with seeds. Even if the seeds be packed in any substance such as moss or sand, there is still danger of transporting the germs of disease. It was by importing *plants* that the *cemiostoma coffeellum* was brought to this country.

On the belief that the coffee trees were getting degenerated in this country, the Government about 28 years ago got some coffee plants from the Islands of Martinique and San Domingo, also some from Bourbon. The very year after these plants were introduced appeared this leaf pest. It has continued its ravages with more or less annoyance to the planter ever since. Damp years seems to favour its fecundity, while ordinary dry years appear to encourage the growth of the fungus which seems to be the caterpillar's greatest enemy.

Mr. Morris in his notes printed in your issue of 13th April says, in reference to Liberian coffee plants attacked by leaf-disease:—"The leaves show perforations scattered here and there over their surface; the fungus seems to be confined to isolated areas, and the leaves being so large, instead of causing them to fall off, a round hole is made through them, as if eaten by a caterpillar. Thus the greater part of the leaf area is left intact, and it is enabled in spite of leaf-disease to discharge its functions as an essential part in the economy of the plant."

At the time I wrote you a description of the leaf-disease of Brazil, some one was in the habit of making free use of your newspaper in its transmission to me, and a great many never reached me at all; among these latter must have been my notes on that subject. As I do not recollect what I then wrote—even at the risk of my present contribution being called dry, I will describe it again.

On every coffee estate in Brazil, on all the coffee trees, from the smallest plant not yet sending out its primary to the largest tree, will be noticed on the leaves brown rusty spots. If these spots are examined carefully, they can be classified thus:—

1. Spots recently formed—from a quarter of an inch to an inch in diameter—with a worm eating the green substance of the leaf leaving the two skins and structure of the leaf intact.

2. Spots that seem older, but show that the caterpillar has been inside and escaped. The upper skin of the leaf-drying and curling up—soon to form a hole in the leaf similar to that describad by Mr. Morris above, and with no worse effect.

3. Spots which show that the maggot has been living inside—but the two skins of the leaf are glued firmly together, and in many cases the larva is entombed inside as dry and hard as an Egyptian mummy.

This fungus spreads on the leaf, forming a yellow border around the brown spot. In this instance—when this new disease attacks the spot the leaves get sickly and fall off, and the tree looks like one that has just borne a heavy crop and like it revives, and readily recovers vigor with the return of the rainy season.

The insect which deposits the eggs on the coffee leaves is a small moth, the outspread wings of which will measure four to six millimetres; the body is about two millimetres long. The wings are yellowish variegated, and the body brownish. It seems to enjoy a happy state of existence, flying about among the thickly growing coffee trees, playing with its mate and seeking out spots to deposit its eggs. It is said to live in the butterfly state for 10 or 12 days. The moths are seen most frequently in the rainy season; the eggs are deposited on the upper surface of the coffee leaf and are said to require seven or eight days to hatch. There may be several eggs deposited in one leaf and consequently form several spots on it after being hatched.

The place where the larva enters the leaf is darker than the rest of the blotch; it seems to enter and form a mine, and continues inside the leaf—living on the soft green substance—for fifteen or twenty days. Its color is yellow with rings showing that it is formed in segments. If several eggs have been deposited in one leaf, the mines may run into each other, as each commences to bore and eat under the upper skin of the leaf as soon as it enters, and continues eating round the outer edge of the spot which turns brown from the time the worm enters the leaf.

If not killed by the fungus which I mention above, the larva escapes at the side of the mine. It then forms a cocoon which is said to be spun in 24 hours after leaving the leaf. This is generally formed in a corner of some of the lower leaves—or as in the cases of those which must have escaped from the leaves of the plants in their way from Europe—among the moss in which the plants were packed. This chrysalis state is said to last for six or eight days when it emerges in the moth. We thus find a periodicity as follows:—

Hatching of the eggs	... ...	7 to 8	days
Larva in the leaf for	... ...	15 to 20	,,
Forming of cocoon	... ...	1 to 2	,,
Pupa or chrysalis state	... ...	6 to 8	,,
Imago or butterfly state	... ...	10 to 12	,,

or say from 40 to 50 days.

This insect is the same as that called *uachista coffeella* by the first writers on it. The names is from *kēmos* muzzle, *stoma* mouth—muzzle-mouth. The hair on the side of its face are said to cover its mouth.

There are however six different species of *cemeostoma*, for a generic name with the specific name derived from their food-plant. *Cemeostoma coffeelum* used to be the only one known outside side Europe. They must be however in Europe, or why should the newly arrived plants have them in an advanced stage?

Every poison has its antidote. What would be the fate of the Brazilian coffee estates if there were not enemies preying on this pest? The fungus I mention above—although it does more harm to the tree than the disease itself does, is still a great means of keeping it in check.

Mr. Pickman Mann, mentions other two powerful enemies, ichneumous parasitic: one *Eulophus cemiostomatis*, which he found feeding on the larvæ, the other *Bracon letifer*, which he found living in the cocoon. These seem to undergo much the same sort of existence as the *cemiostoma*—egg, worm, cocoon and moth—but are smaller, the first mentioned having coppery wings and the other honey-yellow.

This gentleman recommends as a cure the collection of all affected leaves, putting them in a compartment with glass sides, as soon as the muzzle-mouth gets developed, kill it and preserve the parasite—let *him* free, or transport him to where he may be wanted. Or have a house in the middle of the coffee estate with gauze sides, and put diseased leaves in it, the gauze should be of a kind that will let out the parasite but keep in the moth.

My attention has not been drawn to these two parasites practically but there is no shutting one's eyes to the action of the fungus in checking the disease. One may say it is the only noticeable cure there is for it.

As I have mentioned several times before, as a whole the disease does now do much damage in Brazil. It is found on the best coffee trees—those growing in nicely sheltered fatty hollows. I would rather have good coffee with the disease than inferior without it. This, or a disease similar, is also found in the forest and chenas, and is very severe on the trees known to grow only on good soil, the existence of which on his land the Brazilians wears more by than on the color or texture of the soil.

August 6th.—"*Cafe Gagante de Liberia!*" "*Café de Liberia!*" *Liberian Coffee!*" Everywhere at present one meets with these important words,—quite as widely spread in Brazil as "who is Griffiths" is in England. The daily paper (for in Angelica now we get the Rio dailies within forty hours of publication) gives the most prominent part to them. In the towns—in places where coffee planters most do congregate—the walls are covered with posters announcing fresh arrivals of seeds and plants One stumbles against the cases of plants sent for exhibition on railway platforms. In the lobbies of public halls pale-faced young men show off the cases of plants, and the samples of both parchment and cherry coffee, and distribute circulars about Liberian coffee cultivation. I may as well tell you that amongst these latter is a translation of a series of thirteen questions proposed by the Director of the Ceylon Botanic Gardens, and the replies given to these by natives of Liberia. The original I have seen sometime ago in your *Observer* in English.

The coffee was first brought to the notice of the people here by Mr. Oriwell, who brought some seeds from Liberia with him. Distributed a few, and so did I, of the seeds he brought; I did not succeed in getting any to grow. I tried it twice—the first being planted by the late G. A. O.'s own hands, but somehow none came through the ground, nor were any of my friends more successful. Since then cases have been frequently arriving with plants and seeds. The Brazilians are not buying them up very fast, for I notice that they are to sell a large lot by auction in Rio de Janeiro.

I do not think the climate in San Paulo is suitable for it. There is a great difference between ours and the climate of Liberia. In San Paulo the Serra de Mar runs close to and parallel with the coast, and only a small extent of land could be got for growing Liberian coffee at the same elevation that it is grown in Liberia. Almost the same may be said of the Province of Rio de Janeiro. In this latter Province all land that could grow coffee with scarcely any regard to elevation has already been planted on.

The Northern Provinces however, such as Bahia, Pernambuco, Ceara and Para, I fancy should do well for it. But it is quite impossible to introduce it in these places to any extent. The labour difficulty will interfere with it.

Planters ruined by not being able to send sugar and cotton into the market at prices that the planters in other countries can, will not be ready to risk the little they are left with in a branch of agriculture that is in the first place experimental, and in the second, will require five years' labour before returns can be got from it. In San Paulo, hitherto the new coffee has not been much thought of the because of the difficulties experienced in cultivating the species they have. Here too there is little inclination to lay out capital on experiment.

Ceylon, thus, with the Liberian coffee will have it nearly all her own way, and there is every reason to believe that it will be a success. Indeed when you have discovered the proper climate you have everything else there. The labour supply one may say, is inexhaustible. From the district the present Ceylon labourers are taken from only one in twenty-five of the population goes to the coffee-estates. With a consistent and steady railway policy, which the local Government seems generally willing to support, and a generally unanimous front shown by the planters to the Secretary for the Colonies, I see no end to Ceylon prosperity.

WYNAAD NOTES.

October 4.

THE weather has been most depressing again. The two bright days last week were a delusion and a snare, and since then we have been a sort of amphibious animals, and every thing else in the last horrible stage of drip and mould. The coolies come slipping and sliding through the mud to the pulping house, the rain trickling dismally through their loads of fresh picked coffee. Drying it afterwards is a hopeless task. It is in some places regularly rotting off the trees. The weather suits the weeds to a marvel; it also seems to agree with the trees, as far as wood for next year is concerned, but for all crop operations it is excedingly wearisome and disheartening. The coolies are working so badly that one can hardly sometimes believe the stories one hears of their misdoings, until woeful experience brings the unpleasant fact of the utter insubordination of the whole Canarese class personally before one. This is the style of thing : expense is given on Saturday ; on Sunday they get up some sort of *tamasha*, on Monday up come a string of *maistries* to say coolies won't work unless a fresh allowance of "expense" is given out all round. This the dorai refuse, on the plea that most of them only worked half the former week, whereupon these proud and independant spirits pick up their *cumblies*, and retire to their domestic privacy for three or four days,—when they do come out, they either flatly refuse their tasks again, go to their lines, or do not make the smallest attempt to finish what has been set them. Then, of course, the cry at the end of the week is, more "expense," or "How can we live?" and if any demur is made, the simple result is that sundry vacancies occur in the roll on Monday morning!

Leaf-disease seems to have made unpleasant strides during the last few days ; and coffee in low-lying, swampy soil, suffers very keenly. We pay the penalty, too, for any patches which are bearing heavily, the leaves invariably dropping off to the injury of course of trees and crop alike. So many suggestions are made for the destruction of our enemy, and cures for leaf-disease are as plentiful and about as effective as those proposed for cobra bites. One therefore remarks, with more than ordinary interest, any small facts connected with the matter that may occur casually to one's notice. And it is undoubtedly a fact that trees planted close to a cattle pen, or in any place where they have more than the general amount of heavy manuring, do bear constantly great crops without suffering the usual penalty of a succeeding dose of "Leaf." It would be reasonable to infer from this, that heavy manuring is the prevention, if not the cure of the complaint, and as almost everyone now, to the utmost of his powers, goes in for heavy manuring, we must hope that the day is in our future in which we shall tell our successors tales of our bogey and how we happily contrived to dispose of him.—*Madras Times*.

COFFEE IN TRAVANCORE IN 1876-77.

THE Administration Reportof Travancore for 1876-77 has just reached us, and we hope shortly to give it a detailed review. At present we confine ourselves to that part of it which refers to the planting-enterprise in Travancore. A casual reader might peruse the whole of the pamphlet without having his attention specially directed to the important part that coffee plays in the southern State. This is due, in a great measure, to the fact that, in the period under review, the export duty which was abolished in 1875, was re-imposed only towards the close of the financial year. In the body of the report coffee figures less emphatically than tobacco or salt, but a dip into the small print of the appendices at the end will show that coffee is showing a steady increase among the exports of the country. We subjoin a list of the value of the coffee exported during the last six years :—

71-72	5,96,800
72-73	8,39,300
73-74	5,84,034
74-75	5,24,500
75-76	7,86,696
76-77	9,90,058

It will be noticed that not only are the years exports higher than those of the previous year, but also the highest of the six years thus compared by more than a lakh and a half of rupees. The duty paid on the exported coffee was only twenty rupees, but this is explained by what we said above regarding the resumption of the export duty. Only forty cwts. were exported between the resumption of the duty and the end of the financial year. So far as we are aware, Travancore is the most heavily handicaped of all the coffee districts of India, in having (1) a high upset price at the first purchase of the land, (2) a land tax on the acreage of the whole plantation, whether planted or barren, and (3) a heavy export duty on the realised crops.—*Ibid.*

COFFEE PLANTING IN PERAK.

A SHORT time ago, it was announced that two Ceylon planters of experience in coffee cultivation, Messrs. Christie and Handyside were exploring Perak in order to judge by personal observation of the suitability of the soil for coffee plantations. We are now enabled to give the following brief account of their experiences, and the opinions they were enabled to form :—

First of all they ascended Gunong Buboh which is 4,500 feet above the level of the sea, and is the highest point of the range of hills between the sea and Perak river which for the most part has a southerly course from Kwala Kangsa, nearly parallel to the coast. Although favourable in every other respect they report the soil of Gunong Buboh as clayey and not rich enough to offer hopes of a profitable return, should coffee be planted there. They then proceeded to Kwala Kangsa ; thence across the Perak river, and over Gunong Maha Mera to Kinta, travelling over much the same ground as Mr Douglas traversed in his visit to Perak. Here they were joined by Mr. Leech, Assistant Commissioner of Police, and at once started for a high mountain in the Kinta district on the left bank of Kinta river. This mountain they ascended and they judge it to be about 7,000 feet high. From its summit there was descried further inland another and a higher mountain and they determined, if possible, to accomplish its ascent. They found it no easy task, but after two days hard and most difficult walking and the endurance of no little hardship they stood on the top of this hitherto nameless hill, and christened it at once on the spot Mount Robinson in honour of H. E. the Governor. They calculated it to be over 8,000 feet high above the level of the sea. From their position on its summit they had a splendid view of all Perak and Malacca Straits, whilst on the other hand, toward the east, Pahang lay at their feet, and they thought that if the day had been clearer, they might have had a glimpse even of the China Sea, but this is a question.

The soil on these two comparatively lofty hills is described as excellent for coffee planting, and as being more accessible than the Ceylon coffee districts. In fine, these gentlemen have formed such a high opinion of the land that they have applied to the Perak Government for a lease for the formation of a coffee estate, and if the pluck and determination evinced in their recent expedition may be taken as a sample of the vigour with which they mean to prosecute their undertaking, success is more than likely to crown their enterprise. It should be added that they have reported the soil of the Kinta lowland as, in in their opinion, superior to anything of the kind to be found in Ceylon.

CINCHONA.

SALE OF CEYLON CINCHONA.

IN a previous issue it was noticed that a consignment of somewhat over 21,000lbs. bark, chiefly *officinalis*, from Loolcondra and Stellenberg, had netted the sum of £5,900. Particulars of the sale have now reached the Island, and have been placed at our disposal for publication, The results are a great and a pleasing surprise to those interested. A good deal of anxiety was felt as to the bark reaching a falling market and so forth. But lo! the bark which Mr. James Taylor took from what he believed to be trees of *C. officinalis*, (and his knowledge of the species, acquired in Ceylon and during visits to the Nilgiris and British Sikkim, is extensive and accurate,) was pronounced, a large portion of it, to be either calisaya bark or the bark of a hybrid between *C. calisaya* and *C. officinalis*, in which the qualities of the superior species predominated. Messrs. Howard and Whiffen showed the sincerity of their opinion, founded of course, on microscopic and ordinary analysis, by the prices they paid for the bark. For nearly 2,000 lbs. of what was sent away as bark of *C. officinalis* and for which an average of *4s* to *5s* per lb. would not have been deemed disappointing, *8s 2d* per lb. was paid. For twig and broken bark, prices high in proportion were given. Of course, we are ready to modify our opinions by any further light which the cultivators of the trees may supply us with, but at present we strongly incline to the belief that the bark was really that of *C. officinalis*, but so improved by soil, climate and careful preparation, that in quality it approximated to the true "yellow bark" of commerce. The truth is that there is a strong general resemblance between the two species, if species they really are, *C. calisaya* and *C. officinalis*. Both are exceedingly given to sport, their appearance, some with leaves as small as those of peach trees, others with foliage almost rivalling that of *C. succirrubra* (a species which remains very true to type), that the idea of hybridization is constantly suggested. As far as experience and observation have yet gone, quality is dependent on smallness of leaf, and in the case of *C. Calisaya* greenness of [illegible] on the upper side of the leaf with a pink tinge on the under surface and on the midrib. The two species so closely resemble each other that a good tree of *C. officinalis* with small green leaves and pink midribs, might readily be mistaken for a specimen of *C. officinalis* but for the absence of an indescribable *velvetiness* of foliage which distinguishes the latter. As far as our information goes, time sufficient has not elapsed for hybribisation in Ceylon. The first plants reached Hakgala in 1862 and those did not include *C. Calisaya*. Specimens of these came at later dates, but this species has not yet been a success at the gardens. The few trees which have yielded seed are distinguished as *Calisaya vera*, not a superior kind. If hybridization took place, it seems more probable that the process occurred in South America rather than here. But whether in America or here, the result of this sale ought to dissipate the unreasoning dread of crossing which some cultivators feel. Taking into account the fact that Messrs. Howard and Whiffen formed their judgement on bark alone, without having before them the evidence which *botanists* deem essential in the shape of foliage, flowers and fruit, we, with great respect for such authorities must adhere to our belief that the bark which met with such approval and sold for so good a price was just superior bark of *C. officinalis* which, as grown in Ceylon, Mr. Howard years ago described as leaving nothing to be desired. No doubt there are superior and comparatively inferior forms of this species; but all are good, the degrees of comparison apparently being thus regulated:—

Trees with large foliage will have large stems and yield plenty of *good* bark.

Trees with intermediate foliage and stems, a smaller quantity of *better* bark.

Trees with small peach-like foliage and comparatively small stems will yield bark the smallest in quantity but the *best* in quality.—*Ceylon Observer.*

TOBACCO.

FROM the latest Kew report it would appear that the cultivation and manufacture of tobacco is at length seriously attended to in the West Indies, and that seed of the best kinds has been produced and distributed from Kew. With regard to its cultivation in the Bahamas, the Governor writes:—

"The cultivation of tobacco in the Bahamas is rapidly extending, and there are at least three stores in the place at which cigars from tobacco grown in the islands are made. The Agricultural Board has secured the services of a Cuban as inspector of tobacco cultivation. He is very sanguine as to the success of the experiment, and is confident that tobacco as good as that grown in Havana can be raised in the Bahamas. He has given instruction in curing and fermenting tobacco, and expects to export to America several thousand pounds of this season's leaf tobacco. Tobacco has not yet entered into our exports, but I am convinced it will do so on a large scale.

"With regard to the Shiraz seed you sent me, I have to report that every seed germinated, and that I am assured by good judges that though not well cured, this tobacco is of very fine quality, and that its cultivation would amply repay any industrious agriculturist."

The next important country where tobacco promises to become a large commercial product is Jamaica from which island the Governor thus writes:—"You will see from the statements of exports that from nothing before 1871 the values of tobacco and cigars sent out amounted to nearly £5,000 in 1876-77. But this represents but a small portion of the production, because our own consumption is now supplied from domestic sources. I am a smoker myself in moderation, and I don't wish for better cigars than I get here. The manufacture I think particularly good."

The following extracts from a memorandum furnished to the Governor by a gentleman interested in tobacco cultivation in Jamaica will further prove the capabilities of the island for its cultivation:—

"The results obtained by the different planters are, as is well known and admitted even by Cubans not interested in this undertaking, of the greatest importance, and have proved beyond a doubt that our produce is one worthy of attention, and one which will stand competition with that of other countries, the reputation of which has been established long before. As the result of my journey to England and Germany last year, I may mention that in the Hamburg market, the most considerable in the world for tobacco, I found that our produce stood next in rank to the Havana tobacco, to which it was pronounced inferior, but superior to all other kinds, even not excepting those other parts of Cuba, such as St. Jago, Manzanillo, Yara, &c., which furnish such a very considerable quantity to the consumption at home.

"As for the outlet and sale of our produce every one interested has found that the German markets, especially that of Hamburg, has given it the best reception and greatest encouragement. Our tobacco is readily [illegible] there, and though the first hands may buy it as Jamaica, the consumer, in most cases, will not know better than that it is Cuban or even Havana."

"Jamaica has shown that it can produce a tobacco which has proved itself worthy of being introduced as a new article of industry, and, considering the short time that has elapsed since it was first established as such, we have gained a by no means small success. Whatever faults there may exist about the different branches, there are none which time cannot overcome."

Besides the Bahamas and Jamaica, the Fiji Islands appear well adapted for the cultivation of tobacco, judging from a report made of a sample sent to Kew, as well as from samples that have recently appeared in the London market.

WE have pleasure in confirming the announcement made in the London *Standard*, of October 1st, that a Gold and also a Silver Medal have been awarded to Messrs. Sutton and Sons, the Queen's Seedsmen, Reading, England, for their extensive Museum of Seeds, Grasses, Models, &c., at the Paris International Exhibition. Visitors will doubtless remember this fine display of Horticultural and Agricultural Produce in the Gallery of the English Agricultural Annexe, and it is very gratifying to find that in this department Messrs. Sutton sustained their world-wide reputation.

CENTRIFUGAL PUMPS.

PROBABLY to no firm in the world is hydraulic engineering more indebted for its progress of late years than that of Messrs. John and Henry Gwynne, of Cannon Street, London, whose great iron works at Hammersmith, as seen from the Thames, to which they present an extensive frontage, form one of the most notable industrial features of the river scenery at that point in its seaward course. Amongst other important improvements, Mr. John Gwynne of this eminent and enterprising firm has quite recently patented a valuable form of Centrifugal Pump, called the "Invincible," with better justification, certainly, than is frequently the case as regards many inventions, to which pretentious names have been given only to render their implied superiority ridiculous. This pump cannot fail to attract the attention of practical men. It supplies a want long and urgently felt, being so attached to the bedplate that it enables the suction and discharge pipes to be set at any angle without disturbing the bedplate in the least, in consequence dispensing with all ball and socket joints, bends, &c., &c. It also dispenses with foot-valves, the pump being always charged and ready for immediate action.

We may observe that, about ten years ago, Messrs. John and Henry Gwynne, introduced an arrangement for swivelling portable Centrifugal Pumps, which has been largely imitated by other makers, but the idea of swivelling stationary pumps is altogether original. There are several neat arrangements, by virtue of which the same improvement is adapted for Direct Acting Pumping Engines, both for portable and stationary purposes, and also for portable engines driving pumps by belts. By an exceedingly ingenious and useful contrivance facility is afforded for easy inspection of the disc when necessary, and, everything considered, there can be no doubt that the "Invincible" will prove a decided boon to all who require to use this description of pump.

In these days, when other nations are making strenuous efforts to enter into successful competition with our own country, it is always satisfactory to find that English manufacturing industry, in any particular development not only holds its ground, but maintains its old supremacy. We are, therefore, pleased to know that, as respects this firm, their high reputation has been appreciated abroad not less than at home. They are, we may state, the manufacturers of the pumping machinery erected in Ferrara, Northern Italy, for the reclamation of the marshes there, which extend over an area of nearly 200 miles. The pumping machinery put up at Ferrara is the largest in the world, and discharges 2,000 tons of water per minute, being entirely successful in draining the vast area to be reclaimed. In Holland too, very powerful machinery has been erected for the draining and reclamation of vast tracts of land, and we understand that in that country one firm alone has been supplied with twenty-eight pairs of Messrs. J. and H. Gwynne's large Centrifugal Pumping Engines.

Such facts as these are well calculated to reassure public opinion, when newspaper and other writers are too apt to assert that England is being overtaken, if not left behind, in the eager race of international competition.

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NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb. 1876.

R. KNIGHT.

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NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.

LETTERS TO THE EDITOR.

FOREST CONSERVANCY.

SIR,—In your issue for September last there are a letter and an article touching on Forest Conservancy ; one at page 293, on Forest Preservation, the other at page 295 on the *Oudh Gazetteer*, which give conflicting opinions as to the value of the work done by the Forest Department.

Few will deny that forest conservation is a matter of immense and yearly increasing importance both to the State and to the public. But I think a large number of people will agree that forest conservancy can never be thoroughly carried out under the present system ; and that it can never be properly worked till forest officers are assistants to the collectors of districts. At present the Forest Department is very much inclined to work on the "take all and give nothing" principle, quite ignoring rights that have existed and been enjoyed for generations before forest conservancy was ever dreamt of. The officers of the Department having taken this line, it is carried out and worked by their native subordinates very much to the advantage of the latter and results in great vexation and oppression to the villagers who reside in, or in the vicinity of the State forests. It is quite impossible that the single European officer in a huge forest division can know all that goes on, but others hear of it, and are aware that there exists a deep rooted hatred of the Department. I gather from your article on the *Oudh Gazetteer* that Captain Pitcher has found what I have stated, to be the case in Oudh, and that he has taken the part of the people against the Forest Department. As a rule the people living in or near Government forests are an ignorant, unsophisticated race, weakened by fever and other diseases caused by an unhealthy climate, and they have neither the means nor the spirit to resist, what they consider *Sircar ka hookoom*, and unless some one takes their part, the spirit of discontent at the injustice they think is being done them, must increase.

Were the Forest Department worked under the Revenue Officials, I believe that not only would this evil be dissipated, but the hands of forest officers would be much strengthened, while their native subordinates would be more closely looked after, and what is now by no means an unmixed good, might, by judicious working on the "give and take" principle, be made a benefit even in the eyes of those who now fancy they suffer most by it.

Two other points,—*i.e.*, fire conservancy and cattle grazing,—are touched on in the article before referred to. I do not think the Forest Department have yet given decided proofs that the former is an absolute necessity, or that the latter should be stopped, to the detriment of large numbers of people, in order to produce first-class forests of either sâl or other valuable trees. Sâl is perhaps the most valuable timber produced in Northern India, and the one which is supposed to be most damaged by fires and cattle. And yet the evidence of existing forests of this tree does not uphold such a theory. I know numerous blocks of sâl forest through which cattle have grazed for generations and which have been annually fired. In some of these the trees are so close together that they have ceased growing, and you see plenty of small and weakly saplings and but few large trees, while there is no undergrowth and but little grass : all signs that the soil is impoverished and cannot support the trees standing on it. In other places we find fine, straight young trees, with grass growing below, some of which ought to be thinned out to give the rest fair play. And in some other blocks we have forests of first-class trees standing in high grass, and here and there patches thick with young saplings. These are the outturn of fires and grazing !

In our orchards and gardens we do not plant fruit trees or vegetables too close together, because we know we shall not get so good a yield, and if we look at any forest of mature trees we rarely find them growing close together. Nature teaches us that a given area can only produce a certain number of full grown trees.

No doubt by keeping out fires and cattle we may get a thick plantation of saplings. I say we may, because I have seen forests where no young trees were to be found, and other forests apparently similar in all other respects, where they were coming up thickly, and in enclosing a block, barren soil might be hit on. But say the saplings have come up thickly; in order to get good trees we must keep on thinning from the commencement, otherwise we shall get none worth having till the most vigorous have killed off the weakly ones, and as the soil is overburdened, this must be a very slow process. We have therefore the double expense of fire conservancy and of thinning out. Now except in the vicinity of some large station, or where small wood commands a ready sale, we cannot expect to get anything for the young trees that are thinned out. The result is, in out-of-the-way forests, we incur a heavy expense under the above heads. And in the face of the evidence of existing forests, that fires and cattle do permit the production of very good forests without any extra expense at all, I say that to expend large sums on fire conservancy and thinning (*for without the latter the former is of little use*) is unjustifiable. And if, in addition, by so doing we curtail the area of grazing land for large herds of cattle whose existence is of quite as much importance as the forests, and thereby infringe the rights of a large number of people whom we make discontented, I think we have extra reasons for deprecating the introduction of fire conservancy on a large scale, and the restriction of cattle grazing in State forests, unless under exceptional circumstances. And these are, when you have valuable forests of deodor or other firs, in which the trees themselves are liable to burn: or where you can command a sale for every particle of wood cut.

In sub-montane forests the trees unless dry will not catch fire. There are many other arguments which might be brought forward to show that fires and cattle do not do the amount of harm attributed to them, and in fact do good in other ways; such as, the destruction of insect life inimical to trees, and the giving of manure to the soil &c., but they are too lengthy to be discussed here.

What we really want is, that the different methods of conserving should be systematically tried. Let small blocks of one or two square miles each be set apart in every forest division for such trials. In one keep out fires and cattle: in another keep out fires only: in a third burn the grass when it is not quite dry, and so on; and when every plan has been thoroughly tried, then have the one which succeeds best carried out. By this means we shall know we are acting on what has been practically proved, and not on a theory which may answer well in Europe, but may not be applicable to India. Under the present system if we can give the fitful measures now in force such a name, the results are, making the people discontented by curtailing their grazing grounds and preventing their getting wood which they have always been accustomed to take · and keeping up large and costly establishments, which may turn out to have been utterly useless.

KHAIR KHWAH.

CHARCOAL AT NYNEE TAL.

SIR,—At page 351 of your issue of the 1st October last you have a short para concerning the supply of charcoal at Naini-Tal, which does not represent the case in quite its proper light. You say that Mr. Greig has "intimated that the demand for charcoal at Naini-Tal "is beyond the resources of the Forest Department." The present demand for charcoal at Naini-Tal *has* increased beyond the resources of the Government forests of the *Naini-Tal Division*, but not beyond the resources of the Forest Department; a large amount of charcoal might be supplied from other forests under charge of the Forest Department, but the cost of carriage to Naini-Tal would raise the price considerably beyond what the residents would be willing to pay.

You then go on to say:—"Last year it appears 400 trees were "consumed, ... whereas this season 2,000 trees had been felled "by the end of August. It is beyond comprehension how the consump-"tion has thus already exceeded that of last year by 400 per cent. unless "the trees destroyed were mere saplings." *During* the past summer Mr. Greig informed the Naini-Tal Municipal Committee that *since* 1874-75, the consumption had increased from 400 to 2,000 trees; this is a somewhat different version from that given by your correspondent, and it considerably alters the aspect of the case

When the Naini-Tal forests were first demarcated the station was very small compared to what it is now, and at that time the forests were more than sufficient to meet the demands for charcoal &c. Within the last few years the station has increased enormously, and within the last few months it has been decided that the forests cannot become "reserved", under the new Forest Act owing to the numerous private rights existing in them. A study of the Indian Forest Act No. VII of 1878, will show that it is absurd to expect the same yield from a "protected" as from a "reserved" forest; the former cannot be conserved beyond a certain extent, and on that account would not, as a general rule, yield more than half the amount of timber and fuel which, with high conservancy, might be obtained from a "reserved" forest.

To meet the recognised rights of villagers a certain amount of young pine trees have to be supplied annually, and it is a great pity that the use of the saw is not enforced, and this waste of timber put a stop to, but with this exception, or when thinning is considered expedient, none but mature trees are allowed to be felled in the areas under charge of the Forest Department.

Naini-Tal,
1st November, 1878.

J. M. BRAIDWOOD,
Assistant Conservator,
For G. Greig.

WHEAT IN THE HIMALAYAS.

SIR,—The following is the actual record of a late season's crop; ordinary local White Wheat sown:—

Bornint Melela Fields.

Seed—				
3 maunds, 18 seers of Wheat, @ 16 seers ...	Rs.	8	10	0
1 ,, 26 ,, ,, Barley, @ 20 ,, ...	,,	3	5	0
Ploughing	,,	16	4	0
Reaping and threshing	,,	24	5	9
Cost of Manure	,,	4	0	0
Government Revenue (about 15as. an acre per annum)...	,,	6	8	0
	Rs.	63	0	9
Outturn—				
23 maunds, 24 seers wheat, @ 16 seers per Re. (yield equal to 7 fold)...	Rs.	59	0	0
9 maunds, 24 seers barley, @ 20 seers per Re. (yield equal to 7 fold)...	,,	19	0	0
		78	0	0
Leaving a profit of	Rs.	14	15	3

The cost of the land on which the above was grown is about Rs. 350, equal to a return on capital of about four per cent. The foregoing outturn is a very good average one where fields are distant from the hamlets and where only manured at irregular intervals. Where fields are near the hamlets, and manure can be frequently given, the outturn is from 12 to 16-fold, but never higher. Though the yield in such cases is higher, the extra cost of manure might bring the return on capital to about 5 per cent.—a very fair average after all. The outturn also largely depends on the time when the seed is sown, which should be between the third week in September and first two weeks of October; if sown later the produce is stunted and shrivelled.

PEDIGREE WHEAT

obtained from the Government Farm at Cawnpore. The result, on well-manured ground near the cattle shed, was 16 fold, besides obtaining a crop of green food (*kasil* or *kawid*) in the middle of April, for the cattle, a most unexpected treat to them; it was mixed with the dry hay to prevent diarrhœa occurring among them. The natives of the place were quite astonished at this "topping of the wheat" (cut down to within 9 inches from the ground) and looked upon it as the act of a madman: but their astonishment was still greater when they saw the wheat springing up with greater vigour than before *from ears*, and give a larger return.

Seeing the success of this experiment seven or eight zemindars have applied for this kind of wheat seed—*giving their seed in exchange, weight for weight*,—with the intention of adopting it for the benefit of themselves and of their cattle. It is to be hoped that they will be satisfied with the result of their trial and that others may follow their example, as it gives a supply of green fodder at a time when fodder of any kind is extremely scarce, and cattle become very weak for want of nourishment.

The maund herein alluded to consists of 40 seers, each seer 2lbs. avoirdupois. Elevation of fields, about 6,450 feet; situation, Koteghur. On most plantations there are large areas of uncultivated ground on which planters might raise cereals to feed themselves and their labourers.

G. P. P.

P.S.—4 seers of pedigree wheat seed sown gave an outturn of 64 seers, which is equal to 16-fold, beside the crop of *kawid* cut in April.

BAMBOO—ITS CULTIVATION FOR PAPER STOCK.

SIR,—I sincerely hope your editorial footnote to my letter on the above subject in your September issue may elicit some response; this being the more desirable as from the Royal Botanical Garden Report of August 1878, much misapprehension on the subject may I fear ensue. I quote from the Report: "The proposals of Mr. Routledge, who has "devoted much attention to the subject about '*coppicing*' Bamboo and "extracting from its immature shoots a stock fit for the manufacture "of paper, have been put to a practical test during the past two or "three years. Although the experiment has been conducted under the "most favorable circumstances the "*twigs*" produced by each clump "of bamboos are not the soft succulent shoots which are required for "Mr. Routledge's purpose, and on the whole Dr. King thinks that the "proposed industry is not likely to succeed in India."—You will perceive, Sir, I have italicised two words *viz.*, "coppicing" and "twigs": fancying I might be mistaken in my interpretation of these two words, I have just referred to Chambers' Dictionary and find that 'coppice' "is a wood of small growth for cutting" and 'twig' "a thin branch of a tree." Now neither in my pamphlet (copy of which you have) nor in my extensive official and other correspondence have I ever mentioned any idea of "coppicing" Bamboo, but have invariably referred to cutting the young shoots of the seasons growth or a certain portion of them from the parent stool or clump, and such shoots varying from 3 to 8 inches in diameter according to the variety of the bamboo, and growing from 30 to 60 feet high or more within 2 to 4 months most assuredly cannot be called "twigs." I am utterly at a loss therefore to understand this misinterpretation of my views, especially as at the request of Lord Salisbury some two years ago I sent out to Calcutta a box of samples of stem cuttings, both in the young condition I desired to receive, as well as specimens of those too old and woody for my purpose. And these stem cuttings averaged certainly from 2 to 8 inches in diameter. I received them from Demerara and believed them to be shoots of *Bambusa vulgaris.*

It is therefore now most mortifying to find my views so misunderstood and misstated in an official report, as I must repeat, I most certainly neither "proposed to *coppice* bamboo, nor to use the *twigs* from the branches for paper-stock." I should indeed just as soon have thought of using the roots, or the ground they grow in.

Dr. King correctly states I reported on the other Indian plants sent me, and although they, or indeed many others, plentiful and cheap enough in India, would make paper, neither it nor the fibrous stock produced from such plants, would be suited to European requirements, either on the score of quality or cost.

When cutting or cropping the young season shoots of bamboo from the parent stool not more than two-thirds of the growth should be taken, and these should be cut some 3 or 4 feet from the ground. The stumps thus left will throw out a copious "coppice" growth of "twigs," thus maintaining vitality in the parent clump for an indefinite period: fresh shoots being produced in the succeeding season. I allude to the natural jungle; with a plantation under irrigation I doubt not more productive growth would result.

Claxheugh, Sunderland, }
7th October, 1878. }

THOS. ROUTLEDGE.

HONEY IN INDIA.

SIR,—I have just read CULTIVATOR'S letter of 9th September, in the *Indian Agriculturist*, about "Honey in India," and write to give you what little information I can on the subject.

Honey of a very superior quality is obtainable in the Khasi and Jaintia Hills. The best kind comes from Cherra Punjee, an important place situated on the edge of the hills bordering on Sylhet. On an average 300 maunds are annually exported from these hills, at about Rs. 15 per maund.

I learn that at Shella, another large place at the foot of the hills, below Cherra Punjee, where oranges are largely cultivated, bees are kept in the orange groves. During the summer months, honey is brought round the station of Shillong for sale by the hill people. Some is light in color, and some reddish, the latter has a strong flavour of orange.

I shall be glad if you can give me any information regarding the management of bees. I have lately purchased a queen bee and made a very rough sort of a hive for them; in fact it is merely on old box reversed, which, by the by, is the way the Khasias keep their bees. I have had the bees over a month, and they appear to have taken up their residence in it permanently as I have watched them going in and out. I wish to know how to remove the honey without injuring the bees; how long should they be left alone to complete their hive?

Any information on this subject will greatly oblige

"Nelliville," Shillong, Khasi and }
Jantia Hills, }
Assam, 30th October, 1878. }

PUHARRIE.

NOTE.—We will give the required information in our next issue.—ED., *I. A.*

FLAX MANUFACTURE IN INDIA.

SIR,—A correspondent of the *Madras Times* recently gave Dr. Bidie credit for having remarked, on the subject of "Indian fibres," that to procure supplies of material, "if a mercantile agent takes the field with a bag of rupees and says—I'll give you so much per maund for this fibre, and so much for that other, and seals the offer with an advance, than the ryot opens his eyes and proceeds to business!" Very true; but in what way does the ryot "proceed to business." In the first place he forms most extravagant ideas as to the value or price he should receive for the produce of his land, which was instanced not long ago in the province of Behar, where Messrs. R. Macallister and Co. tried the experiment. At first when the ryots heard about the "bag of rupees" they demanded from Rs. 2 to Rs. 4, and even Rs. 5, per maund for linseed stalk, whereas they had never previously realized more than from four to six pie per maund for the same article, which had been utilized as fuel and for thatching purposes only. Consequently the season of 1877 became pretty far advanced before any considerable quantity could be collected from other districts where the "bag of rupees" had not been prominently put forward, at rates varying from 4 annas to 11 annas per maund for cash on delivery at the retting ground. Then, as regards "advances," this scheme was also put in force during the season of 1878 by Messrs R. Macallister and Co.'s representative at Dinapore, but with unfavourable results, as the contractors and other to whom advances were made, either supplied staple of an inferior quality, or never returned to the mercantile agent. who, after the retting period expired, instituted suits in the Civil Courts to recover the advances. All the suits were dismissed with costs, which surely could not have been the case if necessary precaution had been exercised in making the advances. These facts, however, go to prove that Dr. Bidie was greatly mistaken in his opinion regarding the effect, &c., of a "bag of rupees" and "advances" where the ryot is concerned. But this unsuccessful attempt should not deter others from following up the experiments that have been made. To make certain of success, it is advisable not to trust entirely to the ryots for a supply of stalk, and it would add very considerably to the profits of the undertaking if linseed were cultivated in connection with the manufacture of flax; for instance, the seed, labour, &c., required to till one bigah of land, need not exceed Rs. 16 including rent, and average crop should yield about 15 maunds of seed, which, taken at the low figure of Rs. 3 per maund, would leave a profit of upwards of Rs. 25 per bigah on the seed alone, besides which, the manufacturer would have the fresh, strong stalk at his immediate disposal free of expense, and trouble. The labour, &c., required to carry out the retting process should not amount to more than three annas per maund, and 90 men, women and children working under proper supervision, with implements which would cost about Rs. 100 in all, could turn out at least 20 maunds of scutched flax and tow daily. It must also be remembered that the woody substance of the stalk, which comes off in scutching, is worth about four annas per maund for fuel, &c., which reduces the cost of manufacture to a very low figure.

But not employing patent crushing machines and steam power, a very small capital is required in comparison; the wages of a mechanical engineer, or driver, fireman, &c., and the cost of fuel, oil, repairs &c., are saved, the vexation and delay experienced when the machinery gets out of order, is also avoided; besides a superior quality, and a higher percentage of flax is obtained, by making use of hand labour in this country—matters which must be worth the consideration at least of all those who are interested in the cultivation and manufacture of flax and tow in India. Linseed has been selling here at about Rs. 5 per maund for some time past, and flax is worth form £90 to £100 per ton in the home markets, which, taken with the unsettled state of affairs in Russia, one of the principal flax-producing countries in the world, are also elements that should not be overlooked.

C.

THE SAME.

SIR,—With reference to the letter signed C. I shall feel obliged if you, or any of your numerous readers, will enlighten me on the subject of the retting process therein referred to, which your correspondent states would not cost more than three annas per maund. I have for the first time sown some linseed, but the method of extracting the flax is entirely unknown in these parts—at least to those whom I have questioned on the subject—and as I am anxious, as *C.* advises, to try linseed cultivation in connection with the manufacture of flax, I shall feel grateful for any information C. or any other interested party can give me on the subject.

A GOVERNMENT PENSIONER.

Hazareebaugh, November 9.

THE SAME.

SIR,—With reference to the letter in your columns asking for information on flax cultivation for the 'Indian Sunb," I would mention that it is pretty extensively cultivated in the Punjab. The natives generally steep it in water for about nine days, and the men cut it into lengths of 3 or 4 feet each. The women then separate the fibre with the ordinary reaping sickles. *This method is defective.* The fibre is spoiled by the steeping in muddy water, and the scraping with the sickle breaks it into shreds. When the process is over, the manufactured result is only fit for stuffing bedding, &c. I would suggest that the steeping should be in vats of *pucca* masonry, instead of in the nearest pond. As for the plant, it might be cultivated, or purchased from cultivators, but if the schulling machine were used, which no doubt could be procured through Messrs. Burn & Co., Calcutta, the fibre would be greatly improved. I should be happy to give the gentleman any further information, if he will communicate with me. The fibre is extensively used by jute manufacturers, who procure it from native dealers, but if an improved fibre could be produced, it could be manufactured into cloth, whereas at present it is only used for ropes and gunny bags. The stalks or residue could be made into native matches with sulphur.

PHILO.

THE SAME.

SIR,—Your correspondent PHILO has made a mistake, by confounding *flax* with "Indian sunh" or sûn, as the former is prepared from the linseed stalk only, while the latter is a different description of fibre.

Linseed stalk should be pulled out of the ground—*not* cut, when the seed is *almost* ripe—just as the stalks commence to colour, but before they turn brown. If they are allowed to remain longer in the ground the sap rapidly dries up, and the fibre not only becomes deteriorated, but the difficulty in separating the fibre from the woody substance is greatly increased. Two or three days after the crop has been taken out of the ground, are sufficient to complete the ripening of the seed, when it may be quickly removed by means of rippling combs. The stalks should then be tied up in bundles of about 9 or 10 inches in diameter, and without further delay steeped in tanks of about 12 feet broad and from 20 to 50 feet long. About 3 feet depth of water will be required so as to completely cover the stalk. The time allowed for retting, in this country, averages from 4 to 6 days, as the quality of the stalk and the temperature of the water must be taken into consideration. When the bundles are taken out of the tanks, or dams, they must be opened and exposed to the sun for two days at least, and crushing and scutching may be commenced almost immediately afterwards.

MOGGY.

THE GRADATION OF PLANTS ON INDIAN HILLS.

SIR,—The Indian Government might advantageously have the various stages of plants on the hills graded for the information of those purchasing estates and others, as has been done in the island of Teneriffee, which presents five zones of vegetation, arranged in stages one above another and occupying a height of 3,730 yards. First of all, they have marked out the region of vines; this extends from the shores to an elevation of from 430 to 640 yards, and is the only part carefully cultivated. It exhibits various species of euphorbiæ, mesem-bryomthema, the cacalia kleinia, the dracæna and other plants, whose naked and tortuous trunks, succulent leaves, and bluish-green tints constitute features distinctive of the vegetation of Africa. In this zone, the planter is taught to raise the date-tree the plaintain, the sugar-cane, the Indian-fig, the arum colosia, the olive, the fruit trees of Europe, the vine and wheat. Now what can be more simple than these data for the information of a prospecting planter? and what a lot of trouble it saves a man with estates in different altitudes. The next grade is the region of laurels, and is the woody part of the island, where the surface of the ground is always verdant, being plentifully watered with springs. Four kinds of laurel, an oak, a wild olive, two species of iron-tree, the arbutus callicarpa, and other evergreens adorn this zone. The trunks are covered by the ivy of the Canaries and various turning shrubs, and the woods are filled with numerous species of fern. The hypericum and other showy plants enrich with their beautiful flowers the verdant carpet of moss and grass. This is a picturesque region, but no planter recklessly grows wheat in it, as he is told it is not the proper place to do so. We next mount up to the region of pines, which commences at the height of 1,920 yards and has a depth of 850 yards, or rather breadth of these dimensions, and is characterised by forest trees, resembling the Scotch fir, intermixed with juniper. The fourth zone is remarkable chiefly for the profusion of *retama*, a species of broom, which forms oases in the midst of a wide sea of ashes. It grows to the height of 9 or 10 feet, is ornamented with fragrant flowers, and furnishes food for cattle. The fifth zone is the region of the grasses. Cannot somebody "summarise," as newspaper men say, the zones of Indian hills in this very simple and effective manner?

C. W.

CURE FOR BORER.

(*To the Editor of the Madras Mail.*)

SIR,—Herewith I give the following proposed cure for Borer, and would feel greatly obliged by your giving it a small space in your columns. This is the latest idea of an old Coorg Planter, and it may call forth other opinions by practical men.

Anti Borer, Stem Washing.

"The wash to consist of about equal parts of sifted lime and cow-dung, dissolved in water to a thin consistency. While operating, a supply of this mixture to be kept within convenient distance of the gang, which should number 30 or over, each supplied with an open mouthed *chatty* and a bit of old rag. Apply the mixture from close to the ground to half way up the stem. Care to be taken to have a good supply of the material always within easy distance of the workers; any spare tar barrels would do for this purpose. Applying the wash should commence about the 20th October.".

I have heard some planters say they thought tobacco juice and gum a good thing, but how would it do to mix a little with the lime and cow-dung?

Coorg, 19th October. B. J.

ASHES AS MANURE.

(*To the Editor of the Ceylon Times.*)

SIR,—It is extraordinary what little attention has been paid by coffee planters to ash as a manure. Go wherever you will elsewhere you will find the rudest cultivators, collect and apply ashes as a safe and sure manure, repaying handsomely the trouble of collecting it. In Calcutta and other large towns in India and in the villages all the ashes are collected and used largely in the opium, tobacco, and even tea gardens. Here it is hardly noticed, save by the tobacco and vegetable growers who use it very largely and even pay for it. On every estate, there is a large amount of leaves and prunings, ferns and grasses, that could be utilized in this way. Though the quantity obtained is small, yet it is very valuable when mixed with cattle compost, and particularly in vegetable composts of grass, &c., which it helps to rot and render fit for use in less than half the usual time. Ground coral and lime do not act so efficiently. Ashes besides keep off vermin famously, and in stalls where cattle are kept it could be safely spread without fear of doing harm to the animals, while it will not expel the ammonia from droppings, as Lime is very apt to do. In India cattle compost mixed with ashes or prepared with a *daily addition* of ashes, in the proportion of *one to six*, is considered half as valuable again as compost without ashes. The extraordinary healthy state and bearing qualities of coffee trees near a set of lines is mainly due to the ashes and that poor stuff thrown out daily by the coolies. When estates are abandoned and lines too disappear, you can trace the spot where the lines stood by the green patches of coffee still vigorous and surviving.

If you wish your trees to be vigorous and have branches loaded with berries in thick clusters from end to end of a branch, use ashes largely, but mixed, of course, with castor or other cakes and compost of any kind. The bumpers in young estates is what the ashes of the heavy burning give, and after two such crops you must re-supply *this material*, or your trees, while even appearing healthy, cease to yield remunerative crops. Too much money is spent on bones for immediate application. Not 20 per cent. of the chemical qualities of crushed bones can come into play. The bones take time to decompose thoroughly, particularly when in a rough state, while ashes, being a manure, have the quality of rendering anything mixed with it fit for absorption by the plant more readily and in a manner *more suited* than coral or lime could.

In the use of ashes there is an *immense* saving; a smaller quantity of compost prepared with it does, and consequently the cost of application is less. Besides, whoever tried it and found it disappointing in its results? One planter who used 5 tons of compost to 2 of ashes got *better* results from it than from 10 tons of plain compost applied to the same extent of coffee. The only objection he raised was the trouble of collecting it and the small quantity obtained after all the trouble; yet why should one give it up so long as it *pays* to do so, though in a small way? Ground coral is very valuable, too, for composts, but it must be in an exceedingly fine state, or it takes a long time before it acts effectually. To those who manure one year trusting for a crop next year, ashes are preferable to lime. POTASH.

THE SAME.

SIR,—A great many manures have been tried and with various success. Oil cakes, such as castor, gingelly, and cocoanut poonac; also bones, refuse fish, lime and coral, &c., have all been tried; but it is a pity comparative and exact results are not published. A writer in your columns of this morning comments on the good qualities of ashes. He says much that is true, but omits to state the cost of this valuable article. A ton of bones costs me at my store £9 15s. If I could get a ton and a half, or even a ton and a quarter of ordinary ashes for that price, I should certainly use bones and ashes with castor for "an immediate application," rather than bones and castor alone. A neighbouring proprietor thinks bones unnecessary for an immediate application, so long as ashes could be had for the same price. The coffee plant not only gets the benefit of the ashes; but the ashes, owing to its mildly caustic properties, improves the condition of the castor. I, however, prefer a slight mixture with it of very fine bone dust or bone meal. The coarser qualities of bones do not decompose rapidly, and even a large portion of the finer qualities have not time to act where the system of "yearly closes" and immediate application is in vogue. You must use some material to help the decomposition of the bones thoroughly. The present system is an awful waste of money, if looked at in a true light. When I was up-country in August, I happened to take a short cut through a field of coffee looking a little "seedy." I met a youngster, an assistant, who was turning up a few holes to see how the manure was progressing. I asked him what he thought of the state of the manure. "First chop," he says, "it stinks horribly, and is full of maggots." Now, this stinking is caused by the decomposition of the gelatine only in the bones. This "green" matter in the bones, as some farmers at home call it, does not last long and does not produce much fruit—the best part and the substance of the bone is turned up next year to be washed down to the ravines and down again to the oyas and rivers. A second "immediate application" follows with the same result.

Coral lime and ground coral are very good, but nothing can beat ashes in "rotting" bones, when you wish to apply the bones as a manure at once.

Mr. Elphinstone's trial of burnt coffee leaves and twigs, has resulted in a ton of it being pronounced worth Rs. 50 as a manure. But ashes must be looked on as a manure *maker*, and is therefore cheap at Rs. 50.

I only saw one small field of coffee treated with castor and ashes in 1876. It was intended as an application to bring on wood, it being rather late to bring on a good blossom; but, strange to say, I was told that the apparently inert and leafless branches put on a new "skin" rapidly, and, with the fresh new shoots in March, '77, there were thick clusters of blossom which brought a tolerably good crop, seeing that year the crops were short generally all over the district.

I should wish to know if sea-weed in quantities or the ash of sea-weed could be collected from our sea-side villages.

NIL DESPERANDUM.

P.S.—The poorer class of farmers in England decompose bones broken into large pieces in barrels, mixing a quantity of ashes with them. The barrels are left in open air exposed to the sun and rain.

CLAYEY SUBSOILS.

SIR,—Can you advise me the best mode of treatment for a sub-soil, like the sample I send you by to-day's post? I do not care to go to the expense of an analysis. I cannot trench two feet without turning this subsoil up. When wet it is plastic, but still incapable of being used by the potter.

I have applied quick-lime, but it takes time to see results.

JOHN W. BARNS.

Bahawulpur, Punjab, 28th October 1878.

NOTE.—The method of treating clayey sub-soils such as that sample of which is sent, is described in the leader on Land Drainage in our issue of October last.—ED., *I. A.*

IRRIGATION AND PISCICULTURE.

SIR,—I have learned that works of irrigation as now carried out, destroy the inland fisheries, instead of fostering them, as they might, and should do. Were they conjointly worked as the means of pisciculture as well as that of agriculture, transit, &c., they might effect the end at little, if any, extra expense.

The worst of it is, however, that the authorities do not realize that the increased production of fish would be an important addition to the food resources of the people, nor do they think it necessary to stop the fearful mischief now being done to the inland fisheries. For instance, at the anicut across the Godavery and the Kistna rivers, millions of fish, on their way up the river to spawn, are annually destroyed. An Engineer who was employed for some years on those works, states that he has seen the destruction by tons of fish full of roe. Thousands of the surrounding population were engaged in the task, and dogs, jackalls, and birds lent their aid. Such a course as this must in time not only exterminate the fish of these rivers, but of all streams tributary to them. In fact, as now carried on, works of irrigation cannot prove otherwise than destructive to the whole of the inland fisheries.

This could not only be remedied, but increased water supply would, in conjunction with the appliances now generally adopted in Great Britain, be the means of multiplying this great staple of food in about the degree probably in which it is now being destroyed.

WATERFORD.

Calcutta, 20th November 1878.

A NEW SOURCE OF REVENUE FOR INDIA.

(*To the Editor of the Paper Makers' Monthly Journal.*)

SIR,—In resuming my comments on Mr. Strettell's pamphlet (in last month's Journal), and in referring to endogenous plants applicable to paper-making purposes in comparison with bamboo, which itself is the largest and most productive of all the endogens or inside growers. I must repeat what I broadly stated in my last letter, that the main points for consideration are, not merely the quality or suitability of such plants for the purpose in view, *viz.*, paper-making, but the quantity of each, or any one description likely to be available for the requirements of the trade, and the cost of producing the fibre therefrom, or rather the probable price at which such fibre could assumably be sold in the market with a reasonable probability of permanent supply, as without some such assurance paper-makers would adopt the use of any new fibre with extreme reluctance.

Endogenous plants suitable for paper-making purposes may be separated into two classes or groups, the first class consisting of those plants in which the fibres are imbedded or enveloped in succulent fleshy or pulpy stems or leaves. From all or nearly all of these the fibres are extracted by hand labour, no machinery having hitherto been invented by which this operation can be performed in an economical and satisfactory manner: the fleshy stems or leaves of this class of plants are crushed or beaten, macerated in water, scraped and roughly combed to separate the fibre from the vascular or pulpy portion of the plant, the yield of fibre ranging from 6 to 12 per cent., and *it is only* where labour is exceedingly cheap and abundant that such a laborious and tedious process could be carried on; with carriage, freight to this country, charges, and the merchant's profit added, it is obvious that the fibre thus produced cannot be sold at a cheap rate.

I may enumerate a few of the fibres in this first class best known to commerce: they are Manilla Hemp, produced from the Musa textilis and other members of the Musa family; Aloe, Agave or Pita Fibre; Yucca, Bromelia Penguin; Sisal Hemp, Hannequin; Pina Fibre, from the Pineapple; Marool, Sanseviera; Phormium-Tenax, New Zealand Flax, &c., &c. All these fibres, if clean and merchantable, secure a high price in the market for spinning, roping, and other textile purposes, few of them indeed sell for less than £20 per ton, and if of superior quality realise from £30 to £35 per ton, or more; and only the tow-waste or damaged parcels are avilable for the paper-maker.

At the head of the second group of endogens we must place Esparto or Alfa, to which we may add Rice and other cereal straws, Diss and other sedges, various reeds and grasses, the latter comprising Sugar-cane and Bamboo.

This latter class of endogens do not require any elaborate system of preliminary mechanical manipulation, but are at once submitted to the ordinary boiling process in alkaline leys, thence passing through the customary processes of paper-making.

All of this latter group of plants, however, are exceedingly bulky, and could not support the heavy cost of carriage from either the East or West Indies, indeed it is only the exceedingly low cost for freight from Spain and Algeria (due to exceptional circumstances), which has enabled Esparto to become as it were naturalised in the paper trade; before it came into use, straw was the only purely raw material employed, but none of the cereal straws, reeds, or grasses can be economically imported into this country, even with their low normal cost, due to the heavy freight and carriage charges, and having regard to the quality of the paper they would produce; neither would it pay commerically to convert them into stock where grown or produced, as the quality of such stock would not permit of it competing with Esparto: it may be assumed, therefore, that although some of these fibres may *possibly* be used for paper-making in the countries where they grow *it will not pay* to bring them to this country.

I think I have shown that it is improbable any increased supply of paper-making materials can be looked for from the first class of endogens, and the same conclusions will also apply to the second class with I believe, one exception, that being Bamboo, which, is the only raw material calculated to compete with Esparto, under the essentially economical conditions of cost and quality. Unfortunately, however due to the reason just mentioned, its bulky nature, Bamboo (a gigantic hollow-stemmed grass) cannot possibly be imported into this country from the tropics, where it flourishes in its raw or natural condition, or even if crushed and dried; it follows, therefore, that it must be converted into "Stock," a fibrous or tow-like condition which will enable it to be baled up under hydraulic pressure, occupying no more space than cotton or jute, and thus delivered to the paper-maker ready for bleaching and converting into paper.

I propose in my next letter to shew how it is that Bamboo stock produced under fairly favorable conditions, can be brought into the market to compete with Esparto, both as to quality and cost, and why I submit that this new industry I propose should meet with the support of the trade.

THOS. ROUTLEDGE.

Claxheugh, 7th Sept., 1878.

RAILWAY CHARGES.

SIR,—I lately shipped a small consignment of tea to England, and beg to lay before you a note of the charges, showing how large a proportion of these were inland. I really think that the Railway Companies ought to carry tea at first class rates. The invoice was about one thousand pounds.

	Pies per lb.
Freight from Dehra Doon to Calcutta	10·644
Freight to England	7·407
Insurance and stamps	2·688
Re-covering, covering in gunny and carting	2·880
Commission	3·840
Sundries	0·288
	27·747

That is to say 2 annas 3¾ pies per lb. Tea is an industry that require fostering, and for such long distances especially, the Railway Companies should try and quote lower.

SNOOKS.

AUSTRALIAN "EUCALYPTUS GLOBULUS."

SIR,—So much attention is now being turned to this tree for plantations for sanitary purposes, that it may not be out of place to mention that it is only one out of a large variety of anti-malarial trees, and by no means the best as regards the quantity and strength of volatile oil in its leaves, &c., nor the value of its timber, though the large size of its seed and its extraordinary quickness of early growth (as compared with its congeners) has forced it into notice, and as it does not thrive in all parts of those colonies even, it may be wise for those who are laying out plantations of it at home to also try some other kinds in case the one sort fails, either wholly or comparatively.

Nearly the whole of our Australian trees are rich in these peculiar essential oils; and it is doubtles owing to this that the atmosphere is so exhilarating, and that no such thing is ever known as fever on newly-cleared lands (as in Canada, India, &c.) And now that the oil is becoming an article of commerce among us. Mr. Bosisto, of Victoria, has been analyzing the extrct from various kinds of trees, and by the result (as follows) E. globulus is almost the poorest one of them all. E. obliqua (stringy bark), 0·500; E. globulus (Tasmania), 0·719; E. goniocalyx (New South Wales blue gum), 0·914; E. leucocylon (species of iron bark). 1·060; E. oleosa (species of Malle gum), 1·250, E amygdalina (New South Wales Messmate) 3·313; also E. bicolor and E. longifolia —two New South Wales species—have a much more powerful eucaliptic odour than any of the above; but as they have not been tested we do not know whether the percentage of oil is really higher or not.

Many of our varieties of "gums" grow to enormous size. Some have been measured from 350ft. up to 400ft., and even nearly 500ft. in height, and from 36ft. to nearly 59ft. in girth near the base: and as some of them flourish in our southern mountain ranges, where snow falls and lies for some time, and sharp frosts are common, there is no difficulty in selecting sorts that will grow in almost any temperate part of Europe; and the timber of which, from its strength and durability, is more valuable then that of most European trees irrespective of the sanitary value of the leaves and exudations while growing.

Should information be required as to the nature, growth and habitat of the above trees, Baron F. von Mueller, of Melbourne; Dr. Woolls, of Paramatta, New South Wales, and Mr. Charles Moore, Director of the Botanical Gardens, Sydney, New South Wales, are both able and willing to give it most fully. It may possibly save many an enthusiastic "planter" much ultimate disappointment if he tries more than one kind in his plantation and obtains the invaluable aid and advice of any of the above named gentlemen first.

I enclose you an extract from Baron Mueller's statement (an irrefragable one) by which you will see that the mammoth trees of the Yosemite Valley in America may "hide their diminished heads" before the superior height and size of some of our Australian trees.

I also enclose a detailed scientific analysis of the eucalyptic oils.

R. D. ADAMS.

Sydney, New South Wales, August, 1878.

The Indian Agriculturist.

CALCUTTA, DECEMBER 2, 1878.

THE INFLUENCE OF CHEMISTRY ON AGRICULTURE.

"IT is utterly absurd," said twenty-five years ago Mr. Pusey, the then President of the Royal Agricultural Society of England, "to put any value upon the doubtful precepts of Chemistry. It has done nothing for Agriculture with the exception of giving a receipt for increasing the efficacy of bones by the action of sulphuric acid, and of proposing to employ flax water instead of liquid manure. We must keep to practice, for it alone is worthy of confidence." Dr. Voelcker would have done well to preface with the above, his paper reviewing the influence of chemical discoveries, on the progress of English Agriculture during the last twenty years, which paper we find in the last issue of the journal of the above Society. When Mr. Pusey, in the prefacing words, gave expression to his opinion on the probable influence of Chemistry on Agriculture, which likewise represented that then held by most English farmers, the conflict between practical Agriculture and scientific Chemistry was raging at its height, and the animosity and passion with which the controversy was carried on by those who prided themselves as practical men, made what should have been a scientific discussion, a turbulent controversy. "What arrogance in science," said those men, "to come and teach us, practical farmers, our business. How can professional men who know not whether potatoes should be planted in March or April, presume to teach us the properties which land suitable for potatoes ought to possess,—or what is the nature of *fallow*? Such scientific explanations are not based on experience; we can ourselves give much better. Whosever should attempt to depose farm-yard manure from its exalted position, deserves to be burnt alive!" The problem which science endeavoured to solve at that time was, how to produce on a certain area more grain, more meat, and more food-stuffs generally, in order to provide for a yearly increasing population. And who can look back now these twenty-five years and say that science has not solved this problem? who can gainsay the victory it has won over practice? or deny the powerful influence which the dissemination of sound scientific principles, the results of the researches of agricultural chemistry, has exerted upon the various branches of practical Agriculture.

Dr. Voelcker gives in his paper an admirable summary of what Chemistry has done for Agriculture. Beginning with the soil, Dr. Voelcker refers to the still very common delusion of farmers, that Chemistry can give infallible recipes for the cultivation of the soil, that the mere numerical results of a chemical analysis can enable the chemist to prescribe for the ailments of the soil in the same manner, as the physician can prescribe for the ailments of the human body. Chemistry, there can be no doubt, has done a great deal to enable us to understand the precise functions which the soil is called upon to perform in vegetable life, and a knowledge of the chemical composition of the soil and of those soil constituents which are essential to plant life, is often of the utmost importance to the practical agriculturist; for a chemical analysis gives frequently decided and satisfactory answers to many questions which puzzle the modern agriculturist and most of which will come under one of the following heads.

1. Whether or not barrenness is caused by the presence of an injurious substance, such as sulphate or sulphide of iron, occasionally occurring in peaty and clayey soils ?

2. Whether soils contain chloride of sodium, nitrates or other soluble salts, that are useful to vegetation when present in moderate quantities, but injurious when they occur in land too abundantly ?

3. Whether barrenness is caused by the absence or deficiency of lime, phosphoric acid, potash or other important elements of plant-food ?

4. Whether clays are absolutely barren, and not likely to be materially improved by cultivation, or whether they contain the necessary elements of fertility, and are capable of being rendered fertile by subsoiling, deep cultivation, steam-ploughing, and similar mechanical means ?

5. Whether or not clays are usefully burnt, and used in that state as manure ?

6. Whether or not land will be improved by *liming* ?

7. Whether it is better to apply lime, or marl, or clay on a particular soil.

8. What kinds of artificial manures are best suited to soils of various composition.

But though Chemistry can give satisfactory replies to any of the above questions, our knowledge of the inherent agricultural capabilities of the soil is still far from being perfect, and it is only since we discovered the peculiar power of different soils to retain available plantfood in physical combination that we can hope to bring this part of agricultural Chemistry to perfection.

Regarding the permanent fertility of soils, the necessity of manuring to prevent exhaustion, and the means at our disposal to raise the fertility of soils to their highest limit, Dr. Voelcker says much what we have repeatedly advanced. Speaking of the lowest yield to which average fertile soils can be reduced by constant cropping, without manuring, and which lowest yield has been termed permanent fertility, Dr. Voelcker says:—"But the term *permanent fertility* is hardly applicable in its full sense to any kind of land; for however rich land may be naturally, its productive power or standards of natural produce will be impaired, it may be very slowly in some cases, but surely in all—if such land is cropped from year to year, and no provision is made to restore to it the elements of fertility which have been removed by a long succession of crops." The effect of different manures, both organic and inorganic, on the continuous growth of wheat and barley is illustrated by Dr. Voelcker by statistics, giving some of the most instructive results of the experiments made by Lawes and Gilbert at Rothamsted. It appears from these results that mineral manures and especially superphosphates had a better effect upon barley than upon wheat, and that nitrate of soda in combination with minerals gives a larger produce, both in corn and straw, than minerals combined with salts of ammonia. This, states Dr. Voelcker, agrees well with the general experience of the British farmer, who derives much advantage from the use of a mixture of nitrate of soda and super-phosphate as a manure for barley; whilst for wheat, *grown on good clay soils* (the italics are ours), a top dressing of nitrate of soda alone, produces as large an increase as a mixture of nitrate with phosphates. On light soils however, continues the professor, which are comparatively poor in available potash and phosphoric acid, it would not be safe to rely upon the exclusive use of nitrate of soda or of salts of ammonia for producing a succession of remunerative corn crops. Whilst fully admitting that the yield of grain crops and other *annuals* in England and Europe generally, can be largely increased by the use of nitrates, ammonia and other essentially nitrogenous manures, not so much by their supplying nitrogen, as a wanting element of plantfood, but by the powerful stimulating and food-distributing influence they exert, it must be borne in mind that this beneficial effect is chiefly confined to the Graminaceæ, and is much greater in moderate climates, than in the tropics, where a much larger quantity of ammonia and nitric acid is naturally supplied to the soil by the periodical rains. Most root crops and nearly all the Leguminaceæ, derive very little benefit from the use of ammonia or nitrates as manure, and the results of the Aberdeenshire experiments as well as some of the Rothamsted experiments go, in the opinion of the Marquis of Huntley and Mr. Barklay, who are chiefly interested in the Aberdeenshire experiments, very far to show that in the controversy between Baron Liebig and Mr. Lawes on the subject of nitrogen, Liebig was right, no additional perceptible effect having been produced by the addition of ammonia and nitrates to mineral manures. As for perennial and arboreous plants, the exclusive use of essentially nitrogenous manures is positively injurious, as they stimulate the plants for a time, but weaken them permanently.

But we are transgressing beyond the scope of Dr. Voelcker's paper, and to confine ourselves more immediately to the subject before us, we return to his chapter on manures, which contains much that is interesting. The researches of agricultural chemists who have studied the questions relating to the exhaustion of soils and the means to increase and maintain their productiveness, have done much to make the farmer more independent of the old system of rotation and manuring; and experience has proved that soils will yield continuously quite as large and in some instances much larger returns, by the exclusive use of artificial manures as by the use of farmyard manure, a fact that would, not more than twenty-five years ago, been considered by most beyond the range of possibilities. Referring to the amount of nitrogen in manures which, owing to loss by drainage, are unrecoverable, tables are given, exhibiting the results of experiments extending over a period of 20 years, and showing that of nitrogen, as ammonia, only 32·4 per cent., and of nitrogen, as nitrates, 48·1 per cent. are recoverable in the increase of crops, the rest being lost chiefly by the incapacity of soils to retain in physical combination the final product of all nitrogenous matter, *viz.*, nitric acid. Farmyard manure, according to the teachings of modern Chemistry, is, Dr. Voelcker states, applied by the most advanced farmers in England, *fresh* from the stables or cattle sheds, if possible in autumn or winter. It has then ample time to rot in the soil, and by degrees the nitrogenous constituents of the manure are transformed into nitrates, in time to become effective when vegetation makes a fresh start in spring. Guano and similar ammoniacal manures are applied, either before the wheat is sown or immediately it is fairly above ground, and only in light soils is the top-dressing with these manures deferred till the early spring. Nitrates are generally used as a top-dressing, in most parts of England, towards the end of March, either by themselves or in conjunction with common salt.

British Agriculture, unlike that of any other country has taken the utmost advantage of the teachings of agricultural Chemistry. In the year 1856, Mr. James Caird put the general average yield of wheat in England and Wales at 26½ bushels per acre. In 1868, the same authority raised his estimate to 28 bushels, and in 1876 the Board of Trade puts the average of the whole United Kingdom at 29½ bushels per acre, while Germany and France only average 15 bushels, figures which speak greatly to the credit of the enterprise of English husbandry. The annual consumption of guano, bone-dust and compound artificial manures is greater in Great Britain, than in any other country of the world, and is still yearly increasing. There are in England, Dr. Voelcker states, at present probably a dozen or more manufacturers of artificial manures, each of whom produces annually from 45,000 to 50,000 tons and upwards of artificial manures and many more makers turn out from 1,000 to 20,000 tons each per annum. The importation into England of raw material for the manufacture of these manures is said to greatly exceed 500,000 tons per annum.

The rest of Dr. Voelcker's most interesting paper refers to the researches and discoveries of Chemistry regarding the disposal of town sewage, the improvement of permanent pastures, the feeding and rearing of stock, the industries attached to the farm, and experimental agricultural stations which we will discuss in a future issue.

WELL IRRIGATION:

IN THE NORTH-WEST PROVINCES.

FROM a perusal of certain papers on this subject, including the Circular letter of the Board of Revenue dated 14th November last, we learn what are the chief difficulties in the way of constructing wells for irrigation in these provinces. Were the Government to compel the zemindar to improve his land by constructing wells, it would not only have to advance the money for the purpose, but to empower the zemindar to levy a compulsory water-rate upon the occupant tenants of the lands around the well; a policy in direct conflict with its decision against an enforced water-rate on lands commanded by its own irrigation canals. On the other hand, if the Government exercises no compulsion, but waits until the zemindar applies for the loan himself, the construction of wells would be probably confined to places where the village is held by one zeminder only; joint proprietorship of several zemindars in one village being fatal to all applications for loans for the purpose. A third method might be adopted: the Government might itself undertake the construction of the wells, and levy a rent upon the water, from the people using them. We shall first try to show the comparative advantages of the different modes of raising the water, as the system adopted must, to a great extent, regulate the other arrangements to be made. In the following comparison of the different methods in use in the North-West Provinces, our reason for selecting the Roorkhee irrigation pump is that it is especially adapted for native requirements, its mechanism being very simple and the valves so placed that they can be got at with so little trouble, that any common village *mochee* can repair them.

Method of raising water.	*Quantity lifted per day of 9 hours in cubic feet.*	*Area that can be watered per day in acres.*
Moth (leather bag worked by bullocks) as calculated in Circular of 14th November 1877 ...	2,376	1-6th.
Ditto, (as given in Roorkhee treatise on Civil Engineering) ...	1,350	1-11th.
Gharrá (used in the Eastern Districts, N.-W. P., leather bucket drawn by men, 11 to each bag)	1,944	1 7th.
Hand Pump, Roorkhee irrigating pattern (lift 35 feet, 3 men employed per pump)	990	1-14th.

The quantity of water lifted by *moth* or *churrus*, has been greatly over-estimated in the Circular of the 14th November 1877. The mistake appears to be in the number of lifts per hour, which is erroneously assumed to be 88. Colonel Dickens, late Secretary to the Government of India, D. P. W., (in his report on the Soane canals, published in 1861) found from actual observation, that a *churrus* worked with two pairs of bullocks, with a lift of 28 feet, could be raised only 25 times in the hour; a leather bucket worked by hand is far more expeditiously used than when bullocks are employed (in the Eastern Districts N.-W. P., the proportion watered by men to that watered by bullocks is as 5 to 3), and yet only 90 lifts an hour are made by hand of a bag containing 14 to 15 gallons of water. The Roorkhee estimate of the quantity raised by *moth* may therefore safely be taken as more correct.

The above comparision shews that the Roorkhee irrigation pump, for wells 35 feet deep, is the most economical; for the system known as *gharrá* takes 3·6 times the number of men to work it, and only lifts twice the quantity of water. In other words, the number of coolies employed to work one leather bag would be sufficient for 3·6 pumps, and while these men would lift by *gharrá*, but 1,944 cubic feet per day, by pumps they would raise 3,564 cubic feet. There are other advantages, we believe, in favor of the pumps. Thus a small holding would not need more than one pump; or several cultivators might take one pump between them. Larger holdings would take two or more, according to the area for which irrigation was required. Wells moreover of small diameter only would be required; for if placed at intervals of 2 feet around the mouth, a well 4 feet diameter would admit of 6 pumps.

We may estimate the cost of a four foot well with 6 pumps to be as follows:—

Cost of well...	...	...	Rs.	400
Cost of 6 pumps	...	...	„	600
Fixing pumps, &c.	..	...	„	50
		Total	„	1,050

Six pumps so placed would water an area of 0·428 acres per day, and as the duration of watering for *rubbee* crops may be put down at one month, we have the following estimate of the total irrigation of the year:—

			Acres.
Rubee (in November) days acres 30 × 0·428	...	...	12·8
Sugar cane (during greater part of year)		...	10·
Indigo (in the hot weather)	...	...	12·8
		Total	35·6

If the Government therefore is to get 5 per cent. on its outlay by a water-rent, the return would have to be Rs. 52½ per well, or Rs. 8-12 per pump a year. This is the sum which the cultivator would have to pay, and is equivalent to about Rs. 1½ an acre. A cultivator wishing to irrigate his field from a Government well, would apply to the *tahsildar*, who would register his name, and put him in sole charge of one, or more, of the pumps for the year. A cultivator wanting a share only, of a pump, would not get it until applications for the other shares had been made. To prevent the use of the pumps without paying for them, at the end of the irrigating season the lever handles might be taken to *tahisil* or *thannah*, and re-issued when the arrangements for the next year were made. If well-irrigation is to be carried out on any scale in these provinces some such arrangement as we have shadowed forth, easily understood by the villagers, and simple to carry out and control will be necessary. We have said little about the Circular generally, but it shews, we think, that it has been drafted by some one not practically acquainted with what needs to be accomplished.

C. E.

THE BANGALORE EXPERIMENTAL FARM.

THE annual report by the Superintendent of this Farm, for 1877-78, is now available to the public and contains many facts of interest to the Indian agriculturist. Mr. Harman prefaces his report by some general remarks on the practical utility of his farm, and he discusses ably the means and ways which, in his opinion, would be calculated to further its aims, and to utilise to the advantage of the agricultural interests of the province the expenditure incurred in keeping it up.

He first complains of the want of a method to inform the agricultural public, or at least its best-informed portion, of what experiments are being conducted at this farm and with what results, and states, that as far as he has been able to ascertain, such information as is published, does not reach the classes for which it is intended. We have done our best to assist in the publication of such papers as appeared to us to be of general interest, but we must repeat that, unless a regular monthly report of the progress of the chief experiments conducted at such farms is sent to us, we are unable to persuade the public to take more interest in them. Government complied with our request for some time and published in the *Gazette of India* monthly reports of what was going on, on some of the farms, but for some reason or reasons unknown, no reports have been published for some months past.

Such results for instance, as those of deep *vs.* shallow cultivation, in a year of drought, should have been translated and published in all the chief native dialects of the country. In order to extend this improved method of cultivation most quickly and successfully, to the benefit of the province, Mr. Harman proposes to add to the farm an agricultural class, with the object of imparting to native students the theory and practice of modern agriculture ; and he proposes then to put them in charge of small district farms of twenty or thirty acres each. The sons of land-owners he would more particularly invite to go through a course of instruction at this farm. As a third measure, Mr. Harman proposes to grant certain privileges, such as free land, &c., to those village officials who, after a short training on the farm, would undertake to cultivate land with implements and seed supplied by Government. None of these measures are, however, likely to result in any great or permanent reforms of the native method of agriculture nor are they, in our opinion, sufficiently well conceived, to prove any thing more than abortive. Our views on this subject are well known, and were given at length in our issue of October 1877.

The more interesting part of Mr. Harman's report, is the account of the work done on the farm during the year under review. The live stock has been fed entirely on fodder collected and grown on the farm, and from tables given at page 11 of the report, we see that Mr. Harman estimates that to grow and collect sufficient food for 20 pairs of cattle cost him per annum Rs. 1,870, from which he subtracts the value of 800 loads of manure at one rupee a load, leaving the net cost of the fodder Rs. 1,070. The expenditure of feeding a pair of bullocks for a year amounts therefore to Rs. 58, to which Mr. Harman adds the other expenses, necessary to keep them in efficient working order, such as cooly, shelter, deterioration, shoeing, &c., the estimate of the total actual cost being Rs. 150 per pair per annum. The system of loose-box-keeping introduced at the Bangalore farm, has resulted in yielding a very superior farm-yard manure which, applied at the rate of 20 loads per acre, has doubled the outturn of unmanured land. The chief principle of this system of loose-box-keeping is, that the floor of the box or stall (one for each bullock) is excavated two feet below the surface of the ground. The rubbish of the farm is strewn lightly over the stall every morning after the animal leaves it, and thus, as the boxes are under cover, both solid and liquid excreta, are retained as manure. The animals are turned loose into the boxes.

From experiments made with English and native ploughs, Mr. Harman has come to the conclusion that one ploughing with the English plough drawn by a pair of bull-buffaloes is equal to six ploughings of the native one. The average depth ploughed by the English implement is 5 to 6 inches, that by the native plough 3 inches. We further find in the report detailed tables of the cost and working expenses of the "Double Mhote," introduced and fully described by Mr. Robertson of Madras. The cost of material and of erecting a "Double Mhote" Mr. Harman states at Rs. 210, the annual expenses at Rs. 34 ; against "Picottahs" (the native method of raising water), Rs. 28 prime cost, and Rs. 23 annual upkeep. But the working expenses of the former amount to only Rs. 0-5-10 per working day, but of the latter to Rs. 0-12-8. The "Double Mhote" will on an average raise 56,650 gallons per hour, the native "Picottahs" only 14,136 gallons.

Under the head of "crops" grown during the year under review, we observe as interesting to the general public, that experiments made with Prickly Comfrey show that this unduly praised fodder possesses no advantages over native products but has, on the contrary, many disadvantages. A very successful experiment has been made to grow potatoes as an ordinary field crop in Mysore, together with cotton, on alternate ridges ; the results, considering that the year was generally unfavourable to agricultural operation, must be considered as highly satisfactory.

We are sorry we cannot say the same about Mr. Harman's manure experiments, which are the reverse from being satisfactory. There must have been some special reasons why soil that had been manured with 27 loads of village manure, yielded per acre 1,372 lbs. of turmeric less than an unmanured portion, and why bones also apparently reduced the yield. Theft, want of labour for some of the plots, or other circumstances more or less beyond the control of the superintendent, must have produced these results, but unexplained as the results of these experiments are, they are incomprehensible, and would have been better omitted.

The rest of Mr. Harman's report deals with deep and shallow cultivation, which was fully treated in our issue of January last.

SUGAR CANE MILLS IN BEHEEA.

MESSRS. THOMSON AND MYLNE, in reporting to Government on the subject of an improved sugar-cane mill invented by them, give an interesting account of the introduction of the Beheea Mill. When the jungle portion of the Jugdispur estate was cleared and brought under regular cultivation, the ryots settled on it found many places very suitable for sugar-cane, and as the area under cane increased, the demand for trees for kolms became too great to meet. The necessity suggested a trial of small vertical iron rollers in a strong wooden frame. The difficulty at first was rather financial than mechanical, as the simplest machine to be at all equal to the purpose intended would cost more than the local kolm. The ignorance of the village mistries was a great difficulty, and a serious loss to men at a distance who had taken mills, as skilled men had to be sent round to make repairs and to give; instruction in the cleaning, oiling, and working of the mills. A few mills were set up and offered to some of the best of the ryots on loan, or to purchase, if found to give satisfaction. The offer was accepted with some reluctance ; the experiment was carefully watched, the men were assisted over difficulties, and the result was so far satisfactory that several of the men after crushing their own cane, let or sold their mills to others, and purchased again the following year. Others retained their mills, none were brought back. It soon became known that besides the saving of time and labour, the "goor" from the mills was of a better quality and fetched higher prices than that the *kolm* produced. This is a result of passing the whole cane through the rollers at once, while that for the kolm is cut into very short pieces. The section surfaces being thus exposed to the air, acetic fermentation combined with the acid already in the cane, and with the gluten expressed from the cane by the triturating action of the kolm, destroys much of the granulating element of the juice; instances have occurred where the juice refused to yield any grain. For some time the demand for mills did not extend much beyond the Jugdispur estate and immediate neighbourhood, but as the benefits derived from them became known, the mahajuns advanced money freely. The ryot also found he had time to extend the area of his cane without neglecting other crops, and the demand has increased till the estimated number for next season reaches 4,000. During the cane-crushing season, people come with their money from very great distances, sometimes 100 miles; they see the mills at work and learn all they can so learn as to management &c. In such cases they are advised to bring mistries to learn to make frames, when they need only purchase rollers, iron and brass work. The ryots on the Jugdispur estate pay half when taking delivery of mills and half at the close of the sugar season. A well-to-do cultivator or a mahajan will not hesitate to pay a comparatively high price for a better class of mill. To try what could be done by English makers, several qualities of rollers were imported; the workmanship and material were superior to those of Calcutta, but it was found that complete mills with these rollers could not be sold for less than Rs. 90, Rs. 100 and Rs. 110. Though mills were available with Calcutta made rollers, at Rs. 75 and Rs. 80, the English rollers were preferred.

The people as a rule either cannot or will not, give orders in advance and are much disappointed if mills are not ready when it suits them to come to purchase. There is therefore considerable difficulty in estimating, as well as financial risk in providing the number likely to be wanted for the season, especially when the number is large. For 1877-78 it was 1,564, for 1878-79, it is 4,000. Mills are given on hire either by the bigha of cane or chakee of "goor." The bigha in zillah Shahabad is five-eighths of an acre; the chakee of "goor" weighs about 20 kutcha seers, about 12 bazar seers. In the former case the hire is Rs. 4 to Rs. 5 per bigha, according to the quality of cane, and in the latter 4 pice per chakee. The yield per bigha is from 40 to 90 chakees and the average 60 to 70.

If a mill is worked by a person who understands it, the bearings and pinions kept clean and properly oiled, the set screws kept evenly tight, so that the rollers work quite parallel to each other, and with equal pressure on all the bearings, the work done by a 6-inch roller mill during the season will be at least 15 Shahabad bighas, or say nine and three-eighths acres, and an 8 or 9-inch roller mill worked in a similar manner, by one of the heavy North-West bullocks trained to work alone, will, we believe crush, 11 or 12 acres of cane during the season. A mill thus managed will do good work for at least 5 or 6 years, the brass bushes only requiring to be renewed, and as the old brass can be recast by the local brass-workers, the expense is nominal. The mahajuns of Shahabad and Behees, are beginning to realise that the proper working of a few mills on hire gives a very good return for the money invested. Last year purchases by mahajuns were made of from 8 to 15 mills per individual; more would have been taken could they have been supplied in time.

EDITORIAL NOTES.

MR. ROBERTSON Superintendent of the Government Farm at Sydapet, who, we informed our readers, had proceeded to Bombay to confer with Sir Richard Temple about the establishment of a similar institution in that Presidency, returned to Madras on the 12th ultimo, after an absence of about three weeks, in which time he travelled over 3,500 miles. He made a short stay at Poona, and spent six days with Sir Richard Temple at his residence at Mahableshwur. At Ahmedabad, he had an opportunity of collecting information concerning the productive resources of Guzerat, On the recommendation of Mr. Sheppard, Collector of Kaira, he sent an enterprizing native cultivator of Nerriad to gain a knowledge of practical agriculture in the farm at Sydapet. At Nerriad, Mr. Robertson delivered two lectures on agriculture, one on his way to, and another on his return from Ahmedabad. We are glad to find they appear to be in earnest in Bombay in this matter of agricultural education. Two colleges, we understand, are to be formed, one at Ahmedabad, as the centre for Guzerat and the other at Poona, in connection with the Engineering College as the centre for the remainder of the Presidency. The two colleges will educate to the same standard, and qualify youths for the agricultural degree, equal to that for engineering or medicine, and each high school will have an agricultural class, to be taught by a graduate of Sydapet, in the first instance. These classes will feed the colleges. Below the high schools will be groups of village schools, each group, in charge of an itinerant agricultural teacher, who will have charge of the agricultural training only of the boy's. All tehsildars and other subordinates doing duty in any way connected with the land, will in future be required to hold an agricultural certificate from one or other of the colleges. This is something of what Sir Richard Temple has determined upon and it is greatly to be desired that the Government of India should make a move in the same direction without further delay. With Mr. Robertson's very interesting and almost exhaustive report on his recent visit to the district of Coimbatore before us we may hope notwithstanding the hurried nature of his tour to be furnished ere long with some equally interesting and instructive information regarding the provinces through which he has just passed. Most of the students undergoing instruction in the college at Sydapet hail from the Western Presidency, the majority being Parsees, with a few natives of Guzerat and other castes. The total number on the rolls is 54, of whom one half were admitted at the re-opening of the College in October after the late vacation. In addition to their other studies the students are now undergoing a course of practical farming under Herr Shiffmeyer, the able German analyst.

A BANGALORE paper urges the advisability of resuscitating the cattle show annually held in Mysore until two years ago, when the famine fell upon the land, and almost denuded the country of kine. This show was instituted at the instigation of Colonel Boddom, by Sir R. Meade, the late Chief Commissioner of Mysore, and it had a most beneficial effect on the breed of cattle in the province, for year by year there was a marked improvement in the description of animals brought together. Every advantage is to be gained by encouraging ryots and breeders to improve the breeds, and there can be no two opinions that it would be well worth the while of the Government to renew the offers of prizes. The Government of India has, we observe, sanctioned nearly Rs. 17,000 for prizes for cattle fairs to be held in Bengal and the N.-W. Provinces; and were timely notice of such an intention on the part of the Mysore Government to be circulated widely, advantage could be taken of the annual fair held at Nundidroog to have a cattle show at the same time and place. We are all aware of the great mortality of live stock in the province during the past two years; and it is most desirable that the improvement and extension of cattle breeding should receive State encouragement.

THE Secretary of State has lately forwarded to the Government of India the reports of two of the first tobacco and drug brokers in London, on certain samples of tobacco manufactured by Messrs. Begg, Sutherland & Co. at Ghazipore, and on a paper by the Director of Agriculture and Commerce, N.-W. Provinces and Oudh, on the progress made in the experimental cultivation and curing of tobacco under his own supervision at Kumaon and other similar documents. From these reports there does not appear to be any reasonable probability that Indian manufactured tobacco will find a market in England, both on account of the high rate of import duty, charged in the United Kingdom, which would, it is stated, amount on these samples to no less than 4s. per lb., and because the demand for the kind of tobacco produced, whether from the above cause or not, is wholly insignificant. Both Messrs. Bremner and Co., and Messrs. Jenkins and Phillips (the firms in question) are of opinion that the attention of those interested in the growth of tobacco in India might with advantage be directed to the cultivation and curing of the leaf for cigar manufacture, in which a large and remunerative trade is, it appears, carried on in Java and other Dutch settlements in the East. Messrs. Bremner and Co. suggest that with this object the services of some skilled persons should be obtained from Java or Sumatra, who should be instructed to bring with them proper seed, and should be permitted to select the most suitable soil for experiment. In the event of private enterprise failing to enter on further experiments with Java tobacco, it will be, the Secretary of State suggests, for the Government of India to consider how far it may be desirable for it to embark in the enterprise.

"C. W." writes as follows from Madras: "Next to the tobacco of Cuba and the Rio Negro that grown here and there for amusement in this Presidency is the most aromatic. Anybody can cultivate tobacco with certainty in his garden here. The seed should be sown in September and the cotyledons appear in eight days. The young plants are then covered with large leaves to protect them from the sun. A month or two after they are transferred to a richer soil and better prepared and disposed in rows, three or four feet distant from each other. The whole is carefully weeded and the principal stock is several times 'topped,' until the leaves are mature, when they are gathered. They are then suspended by threads and their ribs taken out, after which they are twisted. This plan answers well in a friend's garden here."

WE are told that green and black bugs are playing havoc in vegetable gardens at Madras. English gardeners use soot and water, which they pour over the plants and vegetables to drive these gentry away. The black bug is terribly prolific, and is by no means ugly with its white stripes and red spots. At "boring" leaves and stalks it is a perfect savage, tearing the plants with its strong forceps and mandibles as a tiger does a deer.

THERE has been a great demand for potatoes in the Punjab this season, and before the growers where aware of the rise in the price of the vegetable the *bunneahs* bought up from the farmers every potato they could lay hands on, at the usual rate from eight to fourteen annas per maund, and sold them at once to the traders from the plains for three and four rupees per maund, clearing two and three hundred per cent. The potato now grown in the Punjab hills is no longer equal, either in size or flavor to what it was a few years ago. More than a quarter of a century back, a few bags of potatoes were distributed among the zemindars of the Simla district for seed, who valued it so little that they made a favor of receiving the seed even as a gift. A few patches of forest here and there were cleared and the potatoes planted; the produce was excellent, and more forest land was cleared, till whole hill sides were laid bare, and it became a rage to grow the prolific tuber. The cultivator each year sold the produce retaining a portion to plant again in the same ground; scarcely any new seed ever having been brought in to replenish the old stock, and the consequence has been fatal, for while at one time the potato grown on the Simla hills was perhaps the largest and best in the world, they have now become miserably small and flavorless. It is evident that something must be done in the way of introducing new seed, if the fruit is not to disappear from these hills.

THE Murree Brewery Company have just received from their hop gardens in Cashmere, about 1,000 lbs. weight of hops of this season's growth. About a third of these have been picked from French seedling plants in their second season, and the remainder from stock imported from Kent, some of the plants being in their first season. The famine in the Valley has of course been greatly against the experiment, and to have attained such satisfactory results in the face of adverse circumstances is most encouraging. We believe that those most interested in the industry now consider that hop-growing in Cashmere has passed the experimental stage.

THE sun-flower was once largely cultivated in the East. The planters in British Guiana, however, have taken very kindly to it as a staple of commerce, growing it in large quantities for the sake of its oil. It yields from 80 to 100 bushels of seed per acre: each bushel giving from 5 to 7 quarts of oil, which has always been given the credit of being the best for lamps, the fibre is very useful for the same purposes flax and hemp are used. Poultry and cattle fatten rapidly on the seeds and pulp: and the young leaves of the plant are a delicious vegetable. The flowers, as many a poor cottier in England knows, are a favorite resort of bees. The Mauritians and Americans are its chief growers now-a-days. It grows well in India, and, in any situation, sun or shade. It is a hardy plant and needs no care or manure for its cultivation.

THE following arrangements have been made for the future supply from the Royal Gardens at Kew of American rubber plants:—Plants of *castillon elastica* will continue to be sent to the Director of the Botanical Gardens at Peradenia in Ceylon, from whence, when they are sufficiently strong, they will be transferred for cultivation in suitable localities in India and Burmah. Plants of the *ceava* caoutchouc will be sent to the Superintendent of the Botanical Gardens at Calcutta for distribution to suitable localities. A large number of plants of the *heavia braziliensis* having already been sent to Ceylon, Burmah and Calcutta, no more plants will for the present be sent from Kew.

THE Director General of Post Offices in India has ordered that, in future, packages containing plants, young fruit trees, bulbs, seed, &c., need not be open at the ends, but may be sent in closed covers with a written description outside of the contents of the parcel. The exposure of plants and bulbs to the air often causes much injury to them, and the American plan now adopted is a great improvement. The maximum length of a packet is to be two feet, and the ordinary parcel rates will be charged.

IN Iroquois country, eighty-five miles south of Chicago, 53,500,000 gallons of flowing water from artesian wells are daily supplied for irrigating land. No well is over seventy-five feet deep. There are 200 wells within a radius of twenty miles all of small bore. The prairie is ninety feet above Lake Michigan, and there is no high land for 200 miles which can furnish a fountain-head to these wells. Paris derives a flowing current of 6,000,000 gallons from two such wells. Three more wells are now being sunk, which, with the old ones, will give a subterranean supply ample for 3,000,000 inhabitants. A correspondent of the Baltimore *Sun* says that engineers are confident that the artesian river flowing under San Francisco, leading direct from the exhaustless lakes of Sierra Nevada, is quite adequate to supply several cities of its size.

IN replying to a despatch of the Government of India reporting on the results of the experiments made with cuzco maize in India, the Secretary of State expresses his opinion that it is undesirable to incur any great outlay on the cultivation of the plant. It was found that as a general rule the experimental crops yielded very little seed, often indeed none, especially where the trial was made in the plains. The experiments, however, are reported to have been successful at Ranikhet, and this summer a large supply of the American seed was sent to Cashmere at the Maharaja's request.

IN South America side by side with the *cinchona* or *bonplandia trifoliata* grows the *unona*, a majestic tree, with straight branches rising in the form of a pyramid. An infusion of the aromatic fruit is a powerful febrifuge and is used as such in preference to the *cinchona* which is more astringent as to its bark. The thermometer where the writer found it growing was 80° to 84° at night and in the day 86°. The water of a river near was 81·7° and of a spring 82°. This tree ought to do well in India.

"MUSCATAL" (Madras) writes:—"I have tried vine-growing for many years in my compound, but, although they have attained great success and cover many hundred feet of trellis-work, I have had only a few scattered bunches of grapes here and there. I have now tried planting fish at their roots and with good effect: and I am advised to use sea weed—the *bucus natans*, which, after storms, is to be had on various parts of the coast, and which forms the resting places and covert of 'flying fish' *(exocetus volitans)* upon the surface of the sea, and in which they are sometimes cast upon the beach."

THE preservation of green maize has increased to such an extent in Belgium, that the farmers have more forage than their stock can consume. The system presents no difficulties: cut the maize when it has just ceased to flower, and the grain commences to form. When sown broadcast, the yield is not so large, but more tender, and can be trenched without preliminary chopping, though this process saves a great deal of trouble at feeding time: when cultivated in drills, the yield is superior, but the stalks are thicker and harder, and here the cutting machine will tell; in any case the fermentation will soften the stems, and impart to them a vinous, sugary flavor quite appetising. A granary, an old shed, will do as well as a trench for magazining the green forage, provided the air be excluded as well as the wet. When in V. furrows or trenches, the stuff should be well trodden down, covered with straw, heath, or leaves, and then with two feet of mould, keeping a sharp look out for a fortnight, to stop fissures. About 3lbs. of salt to the ton of forage is added: some mix straw, but this rather checks uniformity of fermentation; a little cuttings of grass or clover aftermath, will not be bad. The trenching is not affected by wet or dry weather; if the stuff has not to be carted far, it need not be made up into sheaves; in the contrary case, the *binding* will prove a convenience.

A **DISCOVERY** which may perhaps be of some importance to this country, has just been made in America. It is that good sugar can be made from the stalks of Indian-corn. The matter is considered of such general interest that the Government of the United States has taken the matter up, and the Agricultural Department is carrying out experiments to determine whether the manufacture on a large scale would be commercially profitable.

A **CINNAMON** planter in Ceylon calls attention to a fact that has long been recognised in regard to one portion of the Montclar system of coffee cultivation, that of loosening the soil about the roots, in order to allow the air and rain water to enter the ground freely. It is well known to those who have carefully studied cinnamon cultivation, that after a number of years the roots become so densely matted, and the soil about them, even in light sand, so hardened, that many of the plants sicken, and cease to yield good spice. In such cases recourse is had to the free use of the alavangah, or a long fork, with which the ground is loosened below the surface as far as can be reached, and when practicable a little new soil is added, with marvellous effect.

THE Chief Commissioner of Mysore has drawn the attention of Commissioners and Deputy Commissioners to the necessity there is to obtain correct figures of the return of cotton cultivation in the whole province. According to latest returns only three acres of land were under cotton cultivation in parts of the Nundydroog district. In the statistics to be prepared, special attention will be given to quantities of home grown and imported cotton.

THERE seems every probability of our newly created export trade in wheat being extinguished as rapidly as it sprang up by the competition of America. The American exportation of wheat to England this year has been enormous, and has reduced the price of that grain to an unprecedentedly low level, while the Indian exports have dropped from 578,867 cwts. in September 1877, to 74,447 cwts. in September 1878.

SUGAR-BEET is more highly esteemed than the common field beets known as mangels, for stock feeding, and there may be some grounds for the preference, as it contains a larger percentage of sugar, less water and less saline matter. Analyses of sugar beet are, however, usually made with the object of determining the value of the root for sugar producing; whilst in analyses of mangels other properties are inquired into. Thus mangels in a fresh state have been found by Dr. Voelcker to contain flesh forming constituents (that is, containing nitrogen) 2·83 per cent., and in a dry state 15·50 of such constituents. The heat-giving ingredients, including sugar (that is, substances free from nitrogen) are 14·38 in the fresh, and 78·07 in the dry state the mineral matters (ash) are 1·18 and 6·43 respectively, and the fresh roots contained 81·61 per cent. of water. The fresh roots contained 10·34 per cent. of sugar; the dry 56·22 per cent. It is noteworthy that the ash of beetroot has been found by Boussingault to contain 46·93 potash; but "the differences in the relative proportions of the constituents of beet root are so great that it is difficult to say what the average composition of the root is." Much depends upon the soil, season, and climate. It is, however, worth remarking that small roots yield a much larger percentage of sugar than large ones. The yellow globe and the short red varieties of mangel are preferred for feeding purposes to the long ones, on account of their containing a larger percentage of flesh, forming principles and less of water. According to Fromberg the flesh-forming principles in fresh long red mangels were 1·60, in short reds 2·12, and in orange globes 1·94 per cent. In the dry state the percentages were 10·79, 13·88, and 14·40 respectively, thus reversing the position of the short red and orange globe in the wet or fresh state. Mangels, it is well known, possess greater value when carefully kept for some months after lifting than when used in the fresh state. It is customary therefore to store them for use, and in Australia, they are often particularly valuable in the spring and much later in the season. The crop requires good agricultural soil, but is not to be recommended for poor sandy land. Salt is a useful manure for mangels, and wood ashes, green manure, liquid manure, and other fertilisers rich in potash should be employed as largely as possible. The roots contain potash in large quantity, but the leaves contain it in equally large proportions, hence the crop may be deemed an exhaustive one, unless it is fed off upon the land, as it may be to a great extent when it is raised for sheep and cattle.

THE distinguished mycologist, Dr. F. von Thümen, reports that he has discovered two new forms of fungi which occasion considerable damage among garlic and onion crops. In certain parts of the Old Franconia district of Bavaria he has found the garlics completely destroyed by them, more especially when the weather is at all damp. The more destructive of these fungi is evidently a *Helminthosporium* and has been classed by Dr von Thumen as *Helminthosporium vesiculosum.*

WE read that the Central Agricultural Society of France has instituted an inquiry into the so-called "brown disease" (piétain) of cereals. This affection, which is not to be confounded with blight or smut, is especially prevalent in damp seasons, and has its site on the bottom of the stems, between the root and the first and second nodes. It has been observed for a considerable number of years, but was more particularly marked in 1851, when it almost ruined the cereal crops of the National Agricultural Institute at Versailles. The inquiry takes the form of a series of questions addressed to prominent agriculturists in various localities, answers from whom are requested by the Society.

THE Island of St. Vincent formerly possessed in the fruit of the cocoanut tree a valuable and profitable product. About twenty-five years ago, however, a blight afflicted the palms from which they have never recovered. There are now a few, but very few cocoanut palms in St. Vincent, notwithstanding many attempts have been made to grow them. It is calculated that about one million cocoanut palms are in bearing in the Archipelago of the Seychelles, and half as many more young trees will bear within the next five years. In 1875 the quantity of cocoanut oil produced in the Island groups scattered in the Indian Ocean, and which form minor dependencies of Mauritius, amounted to 259,390 gallons. The coir fibre manufactory at Port Victoria is about to be largely developed, and a rope walk and oil crushing machinery are to be added.

AN interesting calculation is published by Herr F. Bilek, as to the comparative returns which may be obtained from the cultivation of a given area of land with vegetables for table and vegetables for seeding purposes respectively. Taking the case of white cabbages, for instance, he states that on ten square metres of ground, at the most about twenty-five of them could be grown. Supposing all of these to do well, they would only sell under favourable circumstances as table vegetables for about a penny apiece, or, say half-a-crown for the lot. If the same area of ground be used for similar cabbages intended for seed, only twenty plants must be put in instead of twenty-five, more room being required in this instance. On the average each plant will produce from 75 to 100 grammes of seed, and taking the lowest of these figures for an estimate, the twenty cabbages will together yield 1½ kilogramme of seed, which, at the average price of twelve shillings per kilogramme, will bring in a return of eighteen shillings, or more than seven times as much as could have been obtained for them if cut for table.

We read that a plague of grasshopers, or locusts, has appeared in the Central American States, and the crops in Salvador, Honduras, Costa Rica, and Nicaragua have been almost entirely destroyed. The land has been turned into a complete wilderness. The exportation of cereals and vegetables produce has been prohibited, and the whole population has been engaged in destroying the insects, men, women, and children alike turning out into the fields for the purpose.

The following valuable experience of ten years is communicated by an English farmer, who, during that period has been very successful in fattening his cattle and sheep :—" Eight bushels of maize soaked in ten pails of water for forty-eight hours then simmered for one hour, and afterwards mixed with 14 lbs. of coarse cheap sugar. It is then intermixed with the chaff, cut hay, or other cattle food. I use no sugar for my horses. My poultry, which never cared to eat dry maize, devour this greedily. I believe that the one thing wanting in maize is to cook it. So many have failed when using it in a dry harsh state. If used dry it should be with other oleaginous or succulent food. The same holds good for dry, hard, undecorticated cotton cake. I know a farmer who grinds together maize and beans, one bushel of each, and one peck of linseed. Maize, as corn flour, would be very unacceptable raw, but the addition of boiling water renders it gelatinous and smooth. As the maize absorbs nearly all the water, the fire under the copper should be moderate, or the copper would burn ; wood is less fierce than coals. Some pour boiling water on the maize for pig feed, but this fails to soften it as compared with long soaking and then boiling. Sheep should not be admitted to the troughs until they are all filled."

We believe Mr. Barnard, the bailiff, attached to the Lawrence Asylum farm recently offered to rent it, and has since resigned upon refusal of his offer. The bacon from the farm is unexceptionable, but, as to the " farming " operations carried out, we are quite in the dark. Cannot a statistical report be made out containing a folio or so of figures and giving an estimate of what may be expected from it ?

COMMUNICATED AND SELECTED.

AGRICULTURE IN NORTH BEHAR.

Mr. D. N. Reid, whose name has been on several occasions before our readers, has given us in a pamphlet entitled " Answers to the enquiries in Chapter I. of the Famine Commission Circular" a very interesting account of Behar agriculture, and the manner and time the different staples of the district are sown, grown, and reaped.

At the beginning of the rains in June, it appears from the pamphlet, maize, millets, *arhar*, early rice, and cotton are sown ; and the nursery beds of paddy for transplating are laid out. At the breaking up of the rains in October, wheat, barley, peas, flax, mustard, and poppy are sown. In February and March indigo is sown ; and during March and April a subsidiary food-grain crop named *cheena* (*Penicum miliaceum*) is grown in many of the opium and barley fields.

The paddy crops are the first to suffer from the failure, or the scantiness of the rainfall ; the plants wither, or remain stunted tufts of grass, unable to mature their seeds. The maize plants are the next to show signs of distress, when the grains do not form on the cobs, or appear in irregular patches. The much-despised millets suffer the least of any of the cultivated grasses in a season of drought. The worst results are produced when there is a scanty rainfall in August, September, and October ; then the paddy fails, and the maize yields but indifferently. The *rubbee* crops, although in a great measure nourished by the heavy dews which fall during the months they are in the ground, never yield enough to reduce prices which have run up with a deficient *khureef* season. And if hail and frost destroy the *rubbee* crops and fruit tree blossoms, over any large area of country, famine is inevitable.

The following statement gives an approximate estimate of the principal crops cultivated in North Behar :—

Table showing the approximate area under the principal crops in North Behar, the average outturns and value of produce to the natives of the province.

Names of principal Crops.	Approximate area under cultivation.	Percentage of cultivated land under each crop.	ESTIMATE OF PRODUCE. Opium.	Oilseeds.	Crude Sugar (*Gur.*)	Cotton Wool.	Cotton Seed.	Tow and Hemp.	Tobacco leaf.	*Bhudui* and *Ughani* produce of food grains.	*Rubbee* produce of food grains.	Indigo Dye.	Grand total produce.	Estimated monetary value of crops to the natives of the province.	Estimated monetary value per acre.	Produce reserved for home consumption.	Produce exported.
	Acres.		Mds.	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.	Rs	Rs. As. P.	Mds.	Mds.
Poppy, (supplementary crops, makai, cheena)	173,133	2 87	24,440	1,038,798	..	..	..	..	..	2,596,995	..	..	3,660,233	10,631,983	61 6 7	3 471,317	188,916
Flax and Mustard ..	400,573	6 64	..	2,727 839	..	..	..	..	..	..	..	..	2,727,839	9,547,436	23 13 0	1,177,839	1,550,000
Sugarcane ..	44,000	·73	..	..	880,000	..	..	..	..	..	..	..	880,000	2,640,000	60 0 0	865,000	15,000
Cotton ..	52,000	·86	..	..	..	52,000	156,000	..	..	..	..	..	208,000	897,000	17 2 3	208,000	..
Sun hemp, patna ..	13 956	·23	..	..	..	..	..	139,860	..	..	..	..	139,860	349,650	25 0 0	139 860	..
Tobacco ..	41,116	·68	..	..	..	..	..	..	616,740	..	..	..	616,740	3,083,700	75 0 0	400,000	216,740
Arhar, (supplementary crops kodo and makai)	1,551,492	25·71	..	..	..	..	..	..	..	9 308,952	10,860,444	..	20,163,896	31,029,840	20 0 0	20,169,396	..
Paddy ..	2,352,000	39·	..	..	..	..	..	..	..	29,408,500	..	..	29,418,500	51,464,872	21 10 2	29,096,500	312,000
Wheat and Barley, (supplementary crops, maize and millets) ..	1,202,619	19 93	..	..	..	..	..	..	..	8,418 333	12,026 190	..	20,444,523	28,039,285	23 5 0	20,444,523	..
Indigo * ..	262,462	3·35	..	..	..	..	..	..	..	..	..	50,000	50,000	5,668,936	23 0 0	...	50,000
	6,034,361	100·	24,440	3 766,637	880,000	52,000	156,000	139,860	616,740	49,732,780	22,836,634	50,000	78,305,090	143,352,717	23 12 4	75,972,485	2,332,656

	Average.	Percentage.	Value per acre. Rs. As. P.
Tobacco	41,116	·68	75 0 0
Poppy, &c.	173,133	2·87	61 6 7
Sugarcane	44,000	·73	60 0 0
Indigo	202,462	3·35	28 0 0
Food Grains, &c. ..	5,573,650	2·37	21 12 3
	6,034,361	....	23 12 4

* The indigo outlay received in hard cash from Calcutta and spent amongst the natives of the districts is only entered, not the gross value of the produce.

In an average year, Mr. Reid states, not more than 300,000 acres are protected in North Behar by irrigation ; and the protection is complete and permanent to about 150,000 acres of poppy land only. These poppy fields yield crops of maize and millets, besides opium ; and the average amount of produce from that area is 1,750,000 maunds, or say 15 maunds of food grain per acre.

In Mr. Reid's opinion irrigation is a dangerous agent in the hands of ignorant cultivators, unless it is supplemented with manure and deep tillage of the soil. If only applied in seasons of great scarcity and famine, it would not parmanently injure the soil, and would certainly help the population to resist famine by producing increased crops ; but when it is indiscriminately used year after year, on unmanured and imperfectly tilled lands, it must have a deleterious effect. His reasons for this assertion are :—First, the canal water supplied by snow-fed streams is too pure in itself to act as a fertiliser, although it may act as a forcing agent. Secondly, canal water contains the same ingredients which the soil it irrigates is most plentifully supplied with. Thirdly, flooding the land in a wholesale manner hardens the subsoil, and the ryot with his imperfect and shallow system of cultivation will never remedy this defect. On the other hand, irrigation supplemented with manure is a blessing to the land, or if the water is impregnated with a fertilising silt nothing could be better for the soil. But under existing circumstances the father is being fed at the expense of his children.

An irrigation scheme for supplying the water courses in the Sarun district with a perennial supply from the river Gunduck is now being carried out; this canal will be able to irrigate 200,000 acres during the *khureef* season. Canal irrigation is supplemented by a great number of wells in North Behar, most of which are built in the vicinity of the poppy fields. These wells are generally very shallow, and in a dry season are not capable of irrigating more than one acre and a half of land.

Maize, the lesser millets, barley, pulses, and coarse rice form the staple food of the people. Maize is sown in June and harvested in September. There are several varieties of this cereal, the most worthy of notice for subsidiary crops in seasons of distress being a small kind which ripens in two months. In land rich in organic matter the maize plant matures its seed with the aid of very little rain, but in worn-out land the rainful required is much more. An excessive fall of rain does damage to the maize crop only when in badly drained and retentive clay soils, and when the crop is cut and gathered in stooks on the fields. The smaller millets form an important article of diet among the agricultural classes of Behar. Many of these are worthy of every attention, but the one principally grown in North Behar, *kodoo*, (*Paspalum scrobiculatum*) should not be cultivated in a civilised country as a food grain crop. It recommends itself to the ryot as a hardy and prolific cereal grass; but, nevertheless, the grain is more fit for pigs than human beings, and it is quite probable that those pigs which "ran down a steep place into the sea" had spent the night in a field overgrown with the *kodoo* plant. The seeds of the wild species when eaten produce temporary fits of insanity amongst the natives. However, on account of its cheapness, well-to-do cultivators grow it extensively to pay the hired field labourers, who receive their wages in kind. There are upwards of 1,000,000 acres under this crop in North Behar, and in many places it is taking the place of paddy. The other millets grown in North Behar for food grains are, *murooa* (*Eleusine coracana*), *sawa Oplismenus frumentaceus*) *tangoonee*, and *cheena* (*Panicum miliaceum*), all these latter mentioned millets have many strong points to recommend them. *Murooa* is a most prolific plant in good soil, indeed it is supposed to be the most prolific of all cultivated grasses, and although requiring good sound teeth to eat it when made into bread, still it is nutritious, and will keep good for years when stored This grain and *bajra* (*Panicum spicatum*), Mr. Reid is of opinion, must have been the corn stored by Joseph for the great seven years' famine of Egypt, as no other cereal grains would have kept in imperfectly made granaries such a long time without spoiling.

Kodoo, *sawa*, *tangoonee*, and *murooa* are generally sown at the beginning of the rains. The *kodoo* takes longer to ripen than the other millets. These crops are little affected by drought or excessive rains. *Cheena* is sometimes sown in October after the rains are over, but more generally in February, March, and April. It is a seventy-days' crop, and with plenty of manure and artificial irrigation it grows to upwards of 6 feet high, and is most prolific; the cattle are very fond of the straw, which makes excellent fodder. The grain is not particularly nutritious, but it keeps for many years without spoiling. Barley is sown in October and November, and reaped in March. If the seed germinates, even should there not be good moisture in the soils, the heavy dews, which fall in Behar during the winter months, bring this crop to maturity without the aid of rain or irrigation; although, of course, a Xmas rain is doubly welcome, and increases the straw and grain. Wheat is also sown at the same time as barley, and is reaped a week or two later. Rust and mildew affect this crop, particularly if the weather is moist and warm. There are several species of pulse sown in Behar, the most important being the *arhur* (*Cytisus cajon*), upwards of 1,500,000 acres being cultivated with this plant. It is sown along with maize, or *kodoo*, in June, and is harvested in April. Frost does great damage to the crop. About 2,400,000 acres used to be cultivated with different kinds of rice, but this crop is giving way to that pernicious millet, the *kodoo*, the paddy being a very precarious crop now, and as it is a surface feeder, it requires heavy and favorable rains to bring it to maturity. No cultivated plant has disappointed the ryot so much as the paddy, during the last few years; and Mr. Reid states that there are great tracts of rice land which have not borne crops for the last five seasons. From June till October fully 50 inches of rain are required to bring this crop to maturity; and the rainfall must be evenly disposed over the months of July, August, and September. Excessive rainfall during the early stage of the growth of this plant will injure it.

The poppy fields, which take up 2·87 per cent. of the cultivated land in North Behar, are the only lands which are *regularly* manured. These fields do not get a change in crops, but produce poppy year after year in succession during the *rubbee* season; and either *cheena* or maize during the *khureef*; therefore it is absolutely necessary that they should be manured every year. It is difficult, says Mr. Reid, to form an estimate of the average weight of manure given to the poppy fields, but on an average he estimates they get a dressing of about 3 tons of cowdung and 10 cwts. of ashes per acre every year.

The indigo *zeerats*, in the vicinity of the factories, are manured in a slip-shod manner by the planters, with the refuse plant from their vats, and the more enterprising among them run the water from the beating vats on to the fields. I am sorry to say that as yet few planters appreciate the great benefit to be derived from the utilization of these manures. I know some who actually sell their *seet* (indigo refuse plant) to saltpetre and sugar refiners for fuel. And the majority of planters simply spread the refuse over the fields, let it lie for three or four months, and then gather it together for fuel for their indigo boilers. However, the few who appreciate this excellent fertiliser dig it in to the land at the rate of 16 tons per acre, and are amply re paid for their labour by increased crops.

There is a simple two-course rotation of crops practised in North Behar; for instance, a field which is sown in *kodoo* and *arhur*, or maize and *arhur*, this year, will, after the *arhur* is cut in the following spring, bear another crop of maize, or one of the lesser millets, during the *khureef* season, to be followed by barley or peas for the *rubbee*. Or if the land is kept bare fallow, after the *arhur* is harvested, wheat and oil-seeds are sown for the *rubbee*. Sugarcane is never planted twice in succession, but after the first crop is cut, a second growth, or ratoons as it is called in the West Indies, is reaped the following year. The second growth is never so good as the first. No rotation, or bare fallowing, is attempted with the paddy fields, except when nature steps in with seasons of deficient rainfall; and now many of the paddy lands are given up to the *kodoo* millet for the *khureef*; and in the friable *churs* barley and oil-seeds are sown.

The *khureef* season is the principal and most important one, as the ryot has to pay 10-16th of the yearly rent of the land for that period, and only 6-16 for the *rubbee*.

(*To be continued.*)

CULTIVATION OF SORGHUM.

THE excellent results which have been obtained from the cultivation of sorghum in the [illegible] climates of this Presidency mark it out as a class of fodder crop well suited for existing circumstances. Grass will not flourish in India except where there are shady skies, a fair amount of rain, and a comparatively cool temperature. Even on the Western Coast, where the rainfall is great, and the sunshine by no means overpowering, kinds fit for the food of cattle are scarce, the prevailing varieties being rank and hurtful. The Madras Government have just collected, a set of papers for the information of the Government of India, affording particulars of recent attempts in cultivating Chinese sugarcane and "Planters' Friend" in this Presidency. The reports are worth the attention of coffee planters who desire fodder for cattle.

There can be little doubt that, though a European capitalist could not expect a return from arable farming in India that would satisfy every want, still laying down a few staples besides tea, cinchona, and coffee would be found an advantage. Unoccupied land ought nowhere to exist upon an estate with high class management. The suitability of sorghum to the damp of the west coast districts is an encouragement to a further test on the hill ranges at from 2,000 to 3,000 feet above the sea, where is situated the theatre of coffee enterprise. South Canara is singularly badly off for sound cattle food. Sheep can seldom be kept in the district unless house-fed, while horses suffer mainly in consequence of the stuff forming their grass. The experiment of Mangalore may be reckoned successful. Plots of sorghum were carefully cultivated in the sepoys' gardens of the 31th Regiment N. I., where the weight of two rupees' seed gave a return of 61 lbs. grain and 638 lbs. straw. The Rev. Mr. Gundert, of the German Mission, also tried by way of experiment both the *sorghum saccharatum* and the sorghum. Unfortunately the minuter facts such as areas taken up, dates of sowing and of harvesting and the like, were not recorded. But the season was one of prolonged rains. On first cutting, after a growth ten to twelve feet high, the same plants produced a second crop six to eight feet in height. Again this indefatigable forage sent out a third growth, which had reached a height of more than two feet at the time Mr. Gundert wrote. Seed was supplied to the taluqs, where its cultivation was generally speaking a failure. This the Collector attributes to want of knowledge on the subject, and the Superintendent of Government Farms was requested to give a memorandum of instructions for the benefit of intending cultivators. The establishment of a district School of Agriculture would, however, nowhere repay the cost so well as in South Canara, with its steady calculable climate; and there could be no clearer admission of its being wanted than the Collector's simple request.

The owners of horses are recommended by Mr. E. B. Powell, the barrister, to grow as he did, the seed in another form, scattered wide spread, in a bed of fairly enriched soil and cut when two feet high. Sorghum is a good substitute in the plains in India, for sativa or lucerne. If planted at the commencement of the monsoon, it will continue to throw out fresh shoots during the monsoon, and even for some time after. Mr. Powell makes the following deductions, which he thinks are fairly accurate, for the Malabar Coast:

(1) That the sorghum will grow well on this coast during the monsoon in any soil.

(2) That in proportion as the soil is poor, it will require a larger amount of manure.

(3) That being a surface grower, its roots require occasional earthing up, owing to the liability of the soil to be washed away by the heavy rain, more particularly when grown on a slope.

(4) That from the time it is planted to the time it is harvested, it requires little or no care beyond an occasional earthing up of the roots.

(5) That of the two kinds, the sorghum is the hardier and better suited for this climate.

The plants of both sorts of sorghum make very good fodder for horses, and the grain is acceptable to poultry. On the summit of the Neilgherries sorghum does not appear to thrive. The Rev. O. Dene planted the two varieties at the Lawrence Asylum Farm, Lovedale, in July, and reaped the crops in November. One sowing was on a rich low-lying loamy soil, the other on a terraced slope of sandy loam. The outturn was at the rate of only 1,120 lbs. of fodder per acre, small compared with maize planted as a comparative crop, which produced more than twenty-five times as much per acre. The plots adjoined each other, and had undergone precisely the same previous cultivation, but from the beginning the two kinds of sorghum had a sickly appearance, and had been quite outgrown by the simultaneous crop of maize. An enquiry into the physiological cause of checked development of the sorghum would be interesting. The Reverend Mr Dene [illegible] not think, taking these experiments as a standard, that either variety is suited for forage at the elevation, over 7 000 feet, of the Neilgherry Hills. But it is of no great imp[illegible] an[illegible] growing sorghum where the grasses and herbage of a temperate [illegible] can take free expansion. Where sugarcane is valu[illegible] is [illegible] the immense streches of sun-beaten country,

For here hath summer fixed her th[illegible],
Intent to reign—and reign alone

The peculiarities of the plant have been watched [illegible] Sydapet Farm since 1875. The soil is light and [illegible] sand [illegible] have little to assist their growth in the [illegible] properties of [illegible] it is possessed. In one instance Mr. Robertson [illegible] crop of the *sorghum kaffrarium* in October [illegible] in January 454 lbs. of grain and [illegible] lbs. of straw per acre with a rainfall of only [illegible] inches falling upon twelve rainy days and [illegible] artificial irrigation. The country all round was parched and scorched. This was a real relief operation, but not done without the employment of the forces within the reach of man. The results are said to be due to the depth of cultivation practised at the Farm and to manuring. Another crop of *sorghum kaffrarium*, sown in November, and reaped in March, with 3·46 inches of rain on seven rainy days, and some aid from irrigation, yielded 194 lbs. grain and 5·795 lbs. straw per acre, which is a very slight pull upon the crop obtained without a drop of irrigation water. It will probably be found that rain has an influence on vegetation not to be looked for either in well or river water. The carbonic and nitric acids taken in during its passage through the atmosphere, are, it is likely, the principal causes of the difference. But however this may be, it may be imagined that a succulent plant like Chinese sugarcane or Planters' Friend is greatly improved by a copious rainfall. When 3·65 inches of rain on thirty-two days befell a Sydapet crop of *sorghum saccharatum* sown in September, and harvested in January, the yield rose to 111 lbs. of grain, and 11,878 lbs. of straw per acre. Possibly a good deal of this extra weight was nothing but water which the plants had imbibed. Yet there must have been from the mere bulk a decided gain in nutritive solid matters. Mr. Robertson thinks "the results given show abundantly that both crops—*sorghum saccharatum* and Planters' Friend (*sorghum kaffrarium*)—are most valuable fodder producers; the former gives a heavier yield of grain than the latter, but I may remark here that the grain of both varieties is unsaleable for use as food, for man; that of the sorghum because of the difficulty in removing the husk; that of the Planters' Friend because of a bitter state which it possesses."

The cost of producing an acre of sorghum varies from about Rs. 17 to Rs. 19 and may be roughly stated as follows:—

Cultivation before sowing	Rs.	4
Seeds	„	1
Manure (net)	„	8
Cultivation during growth	„	3
Harvest operations	„	2

Perhaps the greatest difficulty any one commencing the production of sorghum forage would experience would be the scarcity of seed. The Government Farm only distributed gratis 1,280 lbs. for experimental cultivation in twenty two separate directions last year. Indeed the total stock of seed in the whole of India must be infinitesimal compared with what the requirements of the country would be, if native and European capitalists set about improving their land, and fattening their stock. As a sugar crop, for which sorghum is much in vogue in the United States, the capabilities of the plant have not been investigated at Sydapet. But Mr. Robertson states that "there is every reason to believe that it would be a most valuable addition to the crops of the country in this respect. Occupying the ground only about 100 days, it will without irrigation produce [illegible] about 8 or 10 tons of green sorghum fit for crushing [illegible] experiment made here, with very imperfect [illegible] I found that the crude juice showed specific gravity of 1.090 or 12 degrees density on the Beaume scale, which is higher than the average commonly found in America."

Government, it appears, have sent to America for a supply of the seed of some of the best sugar-yielding varieties. Unless, however, the special machinery for crushing the cane and purifying and evaporating the juice be also procured, it will not be possible to give the production of sugar a full and fair trial under the ordinary annual rainfall. In such a district as Coimbatore, which seldom gets more than 20 inches rain in the year, from its situation at the back of the South West winds, some slight assistance from irrigation may be required, but surprisingly little. A piece of ground in the Municipal Garden at Coimbatore was sown with *sorghum saccharatum* in the middle of February 1876, cut when just about to flower—the proper time to secure the fodder in the best condition—in the middle of April. The crop received an artificial watering only once in ten days, and was at the rate of 6,350 lbs per acre. With plants like the sorghum species which need the sun's rays equally with rain and moisture, there should be green fields at times when the plains of the Madras Presidency only exhibit the [illegible] of the mango.—*Madras Mail Sept.* 3.

THE CULTIVATION OF THE ONION.*

BEFORE entering into the details of the cultivation of this vegetable, which in point of usefulness ranks next to the potato, I will briefly give the history, also the dietetic and medicinal properties, which may be of some interest.

The name onion is derived from the Latin word *unio*, a pearl. The onion, with its congeners, the leek, garlic, &c., are of great antiquity, being mentioned in the fifth verse of the eleventh chapter of the Book of Numbers, on the occasion of the murmuring of the Israelites against Moses at Taberah, in the year 1490 B.C., or [illegible] years ago. There is little doubt of its being indigenous to Egypt, where it was worshipped by the Egyptians; its presumed habitat suggests [illegible] necessary for its proper development.

Considered from a dietetic point of view, it is almost unrivalled, for without the onion and others of the allium family, no substitute could be found that would produce the piquant flavour, either in a raw, cooked, or pickled state, or through the medium of sauces or other condiments, in nearly all of which they form a part. If it was not for the breath becoming infected the consumption of this vegetable would be at least ten times greater than it is; this infection of the breath shows that it must consequently be indigestive, or like cheese, it will digest other food, but will not digest in itself, and therefore is not suited to persons whose digestive organs are weak. The medicinal properties of the onion are—1st, soporific, hence the drowsiness following their being eaten, continuing for a day at least; 2ndly diuretic; 3rdly, diaphoretic, promoting perspiration; 4thly, laxative; 5thly, expectorant; 6thly, deobstruent.

With this preface I will proceed with the details of cultivation. The soil most suited to the requirements of the onion is a sandy soil made rich with fertilisers to which reference will be made hereafter. The next most important matter is the preparation of the soil; upon this in a great measure will depend the amount of success to be attained. Autumn is the time to prepare the soil. After making out the space required, which, however long, should not exceed four feet in width, dig deeply, leaving the earth in ridges, so that the frost and atmosphere can permeate the soil, bringing otherwise inert matter into a state of fertility, necessary for plant food, to sustain vegetation; then place as much well rotted dung as you can spare at the botton of the trenches between the ridges; about January level the soil, afterwards throwing on a good top dressing of rotted manure, well incorporating it with the soil to the depth of six inches. Dry weather is necessary for this preparation, as the ground would otherwise be clammy.

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* Read before the Stratford, West Ham, and Forest Gate Horticultural Society, by Mr. W. J. Freestone, Little Ilford.

It is hardly possible to manure too heavily for this crop, which has the advantage over many other things, inasmuch as it can be grown on the same spot for many years without deteriorating. When the ground is well prepared and settled down, about the middle of February, weather permitting, well tread over the bed to consolidate the earth, which is so necessary to this crop, then with the hoe draw five drills an inch deep, commencing four inches from the edge of each side of the bed; the other three drills will then be ten inches apart; then sow the seed according to its vitality, which can be determined in the following simple way. "Spearing" onion seed is an old practice, yet not known by many and forgotten by others. Yet how many disappointments, as well as time and labour, would be saved if it was more generally adopted? Place, say twenty-five seeds, in a pan, and pour on some nearly boiling water, and in a short time all those that possess vitality will germinate, or "spear," and burst the black skin of the seed, and a small white rootlet will be plainly visible; a knowledge is thus obtained of what percentage is *good* and what bad and whether it is necessary to sow *sparingly* or *liberally*. Having sown the seeds, return the earth to the drills, rake smooth, and, again tread the soil—if a heavy soil they will not require so much treading—then throw on the surface of the bed lime, soot, or wood ashes, which will improve the onion considerably, and also destroy slugs, and prevent, to a great extent, the maggot, to which the onion is subject.

The varieties are numerous; "White Spanish," "James's Keeping," and "Nuneham Park" are good varieties, the last being a fine variety for exhibition, as also is "Trebizond," a new variety. The seeds are, if sown in the middle of February and the weather favourable, about four weeks coming through, while, under adverse circumstances, they sometimes take as long as six or seven weeks. As soon as they are well up weed them, and as soon as large enough, hoe and thin them to about four or five inches apart, eventually setting them out early in June by pulling each alternate one, thus leaving them eigth or ten inches apart. Keep the hoe well at work round and about them during their entire growing period, and water them in dry weather, occasionally with liquid manure, if very fine examples are required.

About the middle of August, or when they have made a good top growth, gently lay them over, holding the base of the stem with the left hand, while with the right hand you bend them down without breaking; better be done twice gently than once roughly; this checks the flow of sap, and the process of bulbing is considerably facilitated; take up and store when well ripened, choosing dry weather for the operation. Thus ends the cultivation of the spring-sown onion.

The fact that the onion is a biennial fully justifies the practice now adopted by many of autumn sowing, as one summer is not sufficient to fully develop the bulb. In Spain, Lisbon, and other hot climes they sow in autumn and plant out in spring, by which means the Spanish onions seen in the grocers' and other shops are obtained. A few words on autumn sowing will perhaps be acceptable. Sow about the middle of August, thin out and transplant about April into richly-manured soil, plant with the dibble firmly, but do not cover the future bulb (or blanched part) deeper than it was before; well water, and they will well repay you. By this means you can have ripe onions ready to hand by the time the last year's store of onions have been used.

I may in some future paper give the cultivation of the shallot, the underground or potato onion, and garlic, as these are generally produced from bulbs instead of seeds.

A PLOUGHING MATCH.

WE see that Mr. Benson, Superintendent of the Experimental Farm at Sydapet, is arranging for a ploughing match to be held in the farm. The date in not yet fixed, but the programme is ready. From it we learn that the prizes are to be divided between three classes Class I. will be open to all Five prizes are to be given as follows.—

1	A Swedish plough, value	Rs. 25
2	An American plough	„ 20
3	Implements or seeds	„ 15
4	Do. do.	„ 10
5	Do. do.	„ 5

Class II, is opened to the students of the Agricultural College only. The prizes here are :—

1	A Swedish plough, value...	Rs. 25
2	An American plough	„ 20
8	Implements or seeds, or agricultural books	„ 12½
4	Do. do. do. ...	7½

Class III. is for ryots or their labourers only. Three prizes are given :—An American plough, value Rs. 20; and two money prizes of Rs. 10 and Rs. 5 respectively.

GRASSES FOR PASTURAGE.

Amongst the interesting features formerly to be found in the gardens of the Melbourne University were examples of native and other grasses and plants adapted for pasturage. For several years past these have been virtually useless; seeds from one tuft have fallen into adjacent ones, and thus the strongest—the fittest to sustain life in the general scramble—have survived, whilst the less robust, but probably the more nutrituous, have succumbed. In Victoria there is now no public institution at which grasses and pasture plants are experimentally grown. The political struggle has prevented progress being made with the Dookie or any other experimental farm, and grasses are not patronised in our Botanic-gardens. In Queensland on the contrary, a great deal of work has been undertaken of late years having for its object to determine what grasses and fodder plants are adapted for the climate of that colony. The commission appointed to inquire into the diseases of stock and plants is doing good work, and Mr. Walter Hill, never fails to afford some useful information on grasses in his annual report on the establishment under his charge. The late drought has imparted unusual interest to the subject of pasturage. Many portions of the country have been rendered quite barren, and our readers will remember the appearance in our columns of inquries in reference to the most practicable method of again clothing the land with pasturage. Mr. Hill acknowledges his obligations to Mr. A. G. Elliott, of Bowen Downs, for specimens of rooted grasses from that district—amongst others of danthonia lappacea, the famous Mitchell grass, of whose hardiness and superior feeding qualities he speaks in high terms. The barley grass is spoken of as good grass, " well suited for sheep feed and young lambs, but it is evidently delicate, requiring rain every four to six months;" amongst thousands of acres of barley grass as dead as the sample he sends appear tufts of Mitchell grass, alive and growing vigorously. One peculiarity of the larger kind of Mitchell grass, which sends down roots for 18in., as thick at butt as a man's finger is that the sap rises up the old stems, which have a cane-like appearance, with ring joints. Mr. Elliott considers the Mitchell the finest natural pasture grass in Queensland. Mr. Hill receives applications from all the colonies, besides America and foreign countries, for seeds of the indigenous grasses, but owing to the difficulty of collecting them in quantity can supply only very small quantities. This is as much as can be expected; a variety or species once obtained, the stock may soon be increased if attention be given to propagation. Amongst the indigenous grasses under trial last year have been several which have proved highly valuable. The large blue grass (Andropogon erianthorides) is a tall strong grass of good quality, producing a heavy crop of rich succulent herbage, furnishing excellent hay; both cattle and sheep relish it in any state. It possesses the great recommendation of seeding rapidly, and of being easily propagated from the roots. Another species, A. gryllus, recognised by its golden beard, is an excellent pasture grass, producing under culture a large quantity of feed during the summer months. A. *laniger* is also easy of culture and luxuriant in growth, much relished by all stock in any state. A. pertusus is a fine winter grass, and can also withstand drought well. There are other Andropogons whose uses are more restricted; thus A. contortus, though a valuable, strong pasture grass, is suitable only for cattle, its spear-like seeds being objectionable for sheep-grazing. A. acicularis, also, is better adapted for cattle than for sheep. The tall cat-grass, Anthistiria avenacea, is very productive under cultivation, yielding a large amount of feed and seed, is much relished by horses, and possesses good fattening properties. The Barcoo grass, another anthistiria, is considered valuable for pasture. When dry the straw is extremely brittle, in which state cattle are very fond of it; under cultivation it reaches a length of 6ft. The mulga grass, eurahne Mitchellana, the principle grass grown in the Paroo and Bello districts, where it grows up the stems of the mulga tree, is always green, and flourishes in the stony rises which are general features of that country. All stock are very fond of it, and under culture its yield is great; this grass is considered by Mr. Hill specially adapted for the coast districts. Panicum Brownii possesses very high qualities for sheep pasture, the leaves and stem being exceedingly nutritious. " It produces an abundance of fine bottom feed, stands the heat well, and altogether is well worthy of a place amongst the cultivated grasses in the colony." Poa Brownii affords good pasture both on rich and poor land, produces abundance of leaf, bears hard feeding, and is a good seed-bearer—a good grass both for summer and winter, and improves greatly under cultivation. Poa parviflora is an annual sheep grass, growing all the year round; agrostis solandri, on the contrary, is a winter grass only, but valuable on that account, as many of the summer grasses afford little feed in the winter. So much has been said by advertisers in favour of prickly comfrey as a forage plant, that we gladly conclude this notice of Mr. Hill's useful labours by quoting his report on the experimental culture of this greatly over-praised plant :—" This forage plant was introduced into the gardens last year, and the plants were divided and planted in different soils and situations in the month of June, but no marked difference in the growth or longevity was noticeable in any particular instance. During the winter months the plants throve very satisfactorily, and the growth was very rapid, yielding a large quantity of leaf fodder. Notwithstanding the roots had penetrated the soil to the depth of at least 2ft. 6in., in the month October the yield fell off to the extent of two-thirds, whilst in the summer a number of the largest and best rooted plants succumbed to the heat of the sun. The living plants however, begain to revive considerably during the succeeding autumn, and are now in a vigorous and thriving condition, but as the season advances I cannot but expect similar results to those previously experienced. As a test of the value of the leaves of this plant for fodder purposes, I supplied them both in the green and dried state to parties who offered them to both cattle and horses, and the report was they refused to eat them. Under these circumstances, I fear the cultivaton of this plant will not prove satisfactory or suitable to the coast country of this colony, the more especially as the cost of production would, in the first place, be a bar against it, and, in the next, there are, in my opinion, many other fodder plants that could be cultivated with less expense and to greater advantage."—*Australasian.*

AFFGHAN AGRICULTURE AND INDUSTRY.

THE Berlin correspondent of the *Times,* in giving a summary of the Russian Military Department 'Notes on Affghan Agriculture and Industry,' says :—

So far as is known the lands belong to local chieftains, who, while letting it to vassals themselves, have to pay a tribute to their suzerains. Only on the well-watered banks of rivers and canals, where agriculture attains to some degree of perfection, is the land owned or rented by individuals. Pastures are always the common property of the clans, steppes being considered nobody's property. Like all other rights and personal possessions, title-deeds are worth but little in Affghanistan. Everybody's hand being against everybody, landed proprietors are frequently expelled, or else expelling others, to transfer themselvs to fresh scenes. Some emigrate to neighbouring Khanates, and by dint of the strong arm manage to establish themselves on ground belonging to another clan. In consequence of the difference of climate in various parts of the country, agriculture is by no means the same thing in the north as in the south. In Cabul the land is well watered by canals, and very fertile. In the valley of the river Cabul, from the Khyber hills to the capital, there is no barren, unproductive soil. Arable land in those parts is so extremely valuable that—a rare thing in Affghanistan—it is amply provided with roads. There are here plenty of ariks or open canals, not to speak of the underground rills, artificially laid down in some parts. These water-courses are constructed by the government or village authorities, or by charitable individuals wishing to confer a benefit upon their neighbours. In the case of Government water-works, a tax has to be paid for their use ; whereas village canals are frequently the joint property of the community. In the Kafiristan mountains agriculture ascends to a considrable height, wherever an arable plot is to be found. In other parts, where corn cannot be sown, the hills are planted with fruit-trees in terraces. The harvest in these parts principally depends upon the amount of rainfall.

South of the Safaid Koh hills in the district of Kuram, agriculture is confined to the valley of the Kuram, which in some parts is 22 miles wide. In this valley, as in all other valleys of East Affghanistan, there is a stony ledge of ground at the foot of the hills unfit for agriculture. The mountains have plenty of arable land that cannot be cultivated for want of rain or wells. Still farther south, in the district occupied by the Mahsood Vaziri tribe, the cultivated land forms only 2 or 3 per cent. of the entire area, the rest being barren for want of water. The few fields there are close to the rivers, where they enjoy the benefit of an occasional inundation.

The Logar and Gazni districts, in the far west of Cabul, are well cultivated, and supply corn to the whole principality.

In Candahar, from the source of the river Tarnak to the capital, the country offers but scanty opportunities for agriculture. Fields, as a rule, follow the river-bank in narrow strips, or sometimes cluster round water-courses, mostly subterranean in those parts ; nor is the lower valley of the Tarnak much more productive. A more cheerful aspect is offered by the Helmund Valley, having fields and gardens to about two versts on either bank, as far as the Seistan lake. South of the Helmund, the barren steppe appears rather unexpectedly. North of the river, the barren steppe, stretching away to the hills, is here and there studded with villages surrounded by oases with artificial irrigation.

Herat, possessing a good soil traversed by several rivers, is considered the most fertile part of the plateau of Iram. Here the harvests are uniformly good. There are two of them every year, yielding forty-fold. The district of Ghorbund is the storehouse of the country ; and such is the superabundance of land that where corn might be grown cattle are frequently pastured. Every now and then the country is the scene of Persian warfare, which prevents the development of agriculture.

Sistan, the basin of Lake Khamun and of the deltas of surrounding rivers, is a plain intersected by low ridges. Two-thirds of the surface is sand, the remaining third being alluvial soil, capable of high cultivation, but mostly occupied by tamarind trees. The delta of the Helmund, with its many parallel water-courses, is very fertile, and wholly under the plough. The fields are here separated by quick-set hedges ; the harvests are abundant, and much is exported.

Of the Turkestan Khanates under Affghan control, Balkh is the most productive, thanks to its extensive system of irrigation. Notwithstanding political troubles and the consequent decrease of the population, Balkh still yields enough to supply some of the neighbouring principalities. The valley of Kunduz, though fertile, is swampy, and has an unhealthy climate, compelling people to live in the hill districts. All attempts at agriculture have failed, colonists invariably succumbing to malaria.

There is a deal of arable, well-irrigated ground in the other Khanates ; but they are too frequently exposed to war and robbery to permit of the labour of the husbandman. In all these parts plenty of good land lies fallow.

The agricultural produce of Affghanistan is very various. Wheat, maize, barley, and millet form the principal food of the population. Rice requiring much water is only planted in the valleys of the tributaries of the Indus, in Kundus, Balkh, and some localities of Herat. Every variety of fruit known in Europe grows well, the rhubarb especially fine. Indeed, fruit is one of the great staples of food in the country, and a principal article of exportation. The Cabul Valley gardens are famous for peaches, apricots, cherries, apples, pears, pomegranates, figs, and quince ; the Jellalabad Valley has also lemons and dates. The white mulberry-tree is found everywhere ; the other species with red fruit is also there. The mulberries are dried, ground into flour, and made into cakes, either with or without corn-flour. Pistachio-nuts are grown in such *quantities in the neighbourhood of Maimene that they are exported in caravans to Persia and Baghdad. It is a peculiarity of the climate that all these excellent comestibles get ripe at a considerable* altitude. *Pomegranates* flourish at 4,500 *ft.* above the sea, while apricots ascend to 8,000 ft., and mulberries to 9,000 ft. Grapes are plentiful, and the making of wine is a chief branch of industry, especially in Kafiristan. Considerable quantities of grapes are dried and eaten as raisins. Some sorts are gathered before they are ripe, and exported to Bombay, &c.

Cattle breeding is another principal occupation. As in the steppes and hills of Russian Asia, clime and soil necessitate a frequent change of pasture. Thus the Ghulzae, Afridi, and other clans pass the summer in the Safaid Koh hills, descending for the winter to the plain of Candahar and the the Indus Valley, and sometimes crossing the frontier into British territory. The Beloochees nomadize in summer near the river Helmund, but in autumn, with the first frost, may be seen wandering to the southern steppes, where water is found only at that season. Excepting in the Cabul Valley, cattle breeding is carried on in all parts of Affghanistan by a nomad population, living side by side with the sedentary and agricultural inhabitants. The nomads rarely apply themselves to agricultural pursuits. Of the domestic animals, camels, dromodaries, and a cross between the two, are used for riding and draught, as well as for the milk and butter they yield ; their flesh is only eaten by the very poorest. The clan Gesarai, living in the hills where camels are of little use, value them, however, for their wool. Cabul has few camels, and only a cart-horse sort of horses. The species of horse called yabu is employed for draught in the hills. A finer breed is seen among the Hazaras, in the Khanate of Maimene, where good specimens command from 20 to 32 roubles. In the south, the breeding and sale of horses is almost exclusively in the hands of the Beloochees ; but a peculiarly valuable kind, introduced by Nadir Shah from Persia, is only met with among the Affghan tribe.

Vesir sheep and goats are very numerous, and considered the most useful animals in the country ; but in Sistan, where they cannot be reared, on account of the insects abounding there, the inhabitants turn their attention to the breeding of cattle. There is a good deal of wool collected, manufactured, and exported.

ON THE EXISTENCE OF PHYSIOLOGICAL RACES AMONG PLANTS IN A STATE OF NATURE.

BY M. ALPHONSE DE CANDOLLE.*

THE experiments of which I gave an abridged account in the *Bulln. de la Soc. Botanique de France,* 1872, and a complete one in the *Archives des Sciences Naturelles de Genevè,* for June the same year, have since been repeated, in a nearly identical form, by MM. Naudin and Radlkofer, an account of whose observations appeared in the *Archives* for July last year. How it has happened that all mention of my researches is omitted therein, I know not, seeing that the object in view and the method employed were the same in both cases ; but the concordance of the results arrived at by us both is not devoid of interest, inasmuch as the question of alterations in plant species under climatic influence is a very important one, and the few observations just referred to are the only ones from which conclusions can be drawn.†

I propose now to give a brief *resumè* of the said experiments and their results, and to add thereto some reflections on the nature of the physiological diversities involved and the present state of our knowledge of the origin of successive changes, whether of form or growth in plants.

The method proposed and followed by myself, in 1872, was to sow in a given spot, seeds of the same species obtained from distant countries, and of which the predecessors had therefore lived for thousands of years under different conditions. I chose twelve species, which in a wild state are spread over the greater part of Europe, and each comprising a greater or less number of distinct types, which some writers have elevated into distinct species. Having obtained seeds of most of them from Edinburgh, Moscow, Montpellier and Palermo, I sowed them on the same day at Geneva. Unluckily, some of them never germinated, and the seeds of *Sisymbrium officinale* exhibited in each packet of different origin, extraordinary differences in size and shape of the seeds and their modes of germination.* Consequently, there remained but two out of the whole number, which gave fairly comparable results. These results were as follows :—

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* *Archives des Sciences Naturelles de Genevè*, March, 1878.

† M. Witmark and other experimental agriculturists have shown that cereals obtained from northern and sown in more southerly latitudes, and *vice versâ,* exhibits results differing from those to be described ; but, it must be borne in mind, in the case of all *cultivated* plants, that man, voluntarily or involuntarily, has exercised a selection which complicates the results arising from natural causes.

Senecio vulgaris.—In their germination and primary vegetation, the seeds from the four localities offered no appreciable differences, but the capitules of the flowers developed more rapidly in the specimens from Edinburgh and Moscow, than in those from Montpellier and Palermo.

A second generation was raised in the Botanic Gardens at Florence, by my esteemed friend Professor F. Parlatore, from seeds supplied by me. In this instance there was a more marked difference in the time of coming up than in the first generation. The seeds from Moscow first showed on 5th October ; those from Palermo on the 22nd. Reckoning from the day of sowing or of coming up to the day of blossoming, the plants from Palermo were always the most backward ; but those from the Edinburgh and Moscow seeds did not retain the relative precocity of the first generation as compared with seed from Montpellier.

Trifolium repens.—I was enabled to compare the seeds of two lots from Moscow and Palermo respectively. The first came up twenty-four hours after the other. From the very first, a striking difference was observable in their vegetation. The plants from Palermo seeds were tall, vigorous, large-leaved ; those from Moscow were low, weakly and with smaller leaves. The one would have given a good swathe for cutting ; the other remained stunted like a stray growth by the roadside ; both blossomed together. A second sowing of the same seed a month later gave nearly the same results ; the differences in growth were as marked, but the Palermo seedlings blossomed two days later than the others.

I now pass on to the observations of my learned *confreres.* M. Naudin sowed at Collioure, Caval-Pyrenees, two lots of seeds, each of eight different species, one lot of seed of each, gathered on the spot, the other lot at Munich, Bavaria. Two lots entirely failed from some cause or other. *Solanum nigrum* gave one plant only for each lot of seed, and *Malva sylvestris,* a single plant only, from Collioure seed. *Daucus carota* (wild) was not observed all through. *Capsella Bursa-pastoris* was eliminated on account of its diversity of types, regarded by some of the best botanists as distinct species. Deducting the foregoing there remained for comparison two, which give the following result :

AT COLLIOURE.

Calendula arvensis.—Germination the same in Pyrenean and Bavarian seed. Ulterior growth feeble in the former, rapid and vigorous in the latter. Blossom simultaneous, as also the maturation of both lots. Plants from Munich seed had, immediately before blossomed seven times the weight of those from Collioure seed.

Sonchus oleraceus.—Munich seed came up later at Collioure than Collioure seeds. The former gave uneven-sized, but fairly vigorous plants ; the latter plants uneven in size and weakly in habit. Blossoming of the latter a trifle later. Weight of plants from Munich seed before flowering only half that of the Collioure seedlings.

The counterpart of these experiments was made by Professor Radlkofer, at Munich, under widely different conditions of temperature and humidity. Eliminating three species, which did not germinate in both lots at once, the results were as follows :—

MUNICH.

Calendula arvensis.—Germination nearly alike in seeds from Munich and Collioure sown at Munich. Growth the same up to blossom. Plants from Collioure seeds blossomed two days sooner. Rest of growth identical.

Sonchus oleraceous.—Collioure seed, sown at Munich, germinated two or three days before Munich seed. Gave finer plants with better growth. Before blossom plants from Collioure seed were twice the size of those from Munich seed. Blossoms three days earlier. Growth of both arrested by frost.

Thus with *sonchus,* as with *calendula.* the Munich experiments did not give precisely the same results with the same seeds as the Collioure experiments, which is remarkable, as the seeds were presumably subject to the same relative conditions at each place.

The following species which failed at Collioure, furnished data for comparison at Munich :—

Solanum nigrum.—Seeds from Collioure came up much (17 days) earlier, than seeds from Munich. There was only a day's difference in the time of blossom between the two. Plants from Collioure seed ripened their seed seven days earlier, than plants from Munich seed.

Daucus carota (wild).—Seeds from Collioure came up two days later than seeds from Munich. They grew slowly. The commencement of blossom was much (21 days) later than in the plants from Munich seed, but then they grew freely, attaining a size half as large again as the plants from Munich seed.

To sum up : the experiments comprised six species only, proof sufficient of the difficulties which attend the choice of plants, and the conduct of the details in *bonâ fide* comparative culture.

After suggesting the method, I was enabled, to observe, satisfactorily, *two* species through *two* successive generations. MM. Naudin and Radlkofer, observed *four* species through a single generation, but then this observation was effected simultaneously at Munich, and at Collioure. The results obtained differ very much, that it is necessary to put them in tabular form :—

		Germination.		Growth.		Blossom.		Ripening of Seeds.	
		N.	S.	N.	S.	N.	S.	N.	S.
Senecio vulg.	1s. gen....	Idem.	Id.	Id.	Id.	e			
,,	2d. gen....	o	Id.	Id.	Id.	e			
Trifolium rep.	1s. gen....	ó		vig.		Id.	Id.		
,,	2d. gen....	Id.	Id.	vig.		e			
Calendula arv.	Collioure..	Id.	Id.	vig.		Id.	Id.		
,,	Munich ...	Id.	Id.	Id.	Id.		e		
Sonchus o	Collioure..		o	vig.		6			
,,	Munich....		e	vig.			e		
Solanum n	....		e			Id.	Id.	e	
Daucus Carota	....	e		vig.		e			

N.B.—In the above table N., means seed from northern localities Edinburgh, Moscow, and Munich ; S., seed from southern localitiess Palermo, Montpellier, and the Pyrenees (Collioure). *Idem,* means that the phenomena were of simultaneous occurrence in both lots ; ó stands for moderately early, e for early, and vig., vigorous growth. Germination, and blossom appear to be the phenomena in which differences depending on the origin of the seed are least frequent. Differences of growth were not very clearly established, except in the case of *Tryfolium rep. Senecio* from the northern seed blossomed sooner than that from southern seed As regards other phenomena and the other species, the facts observed as a rule, were obscure or contradictory. Still, despite these obscurities and contradictions, the following points are clearly established :—

1. That seeds of the same species brought from widely distant countries, and sown side by side, under like conditions, do *not* produce individuals identical in their mode of vegetation.

2. That, despite analogies in external forms, diversity of vegetation resulting from differences of origin, is more marked in some species than in others.

In one species (*Senecio*) the difference in the mode of vegetation appears hereditary at least in individuals from the two localities in question. It would be well to observe this peculiarity through a series of generations, although it is now generally believed that differences, even of minor degree, are more or less hereditary.

At first sight we are tempted to defer these adversities to prolonged climatic influence on the ancestors of the individual observed. But it is necessary to know first whether the seeds of the same species, gathered in the same locality, and sown side by side, would not some times exhibit analagous differences in their vegetation. The influence of soil, of previous cross-fertilizations, of a struggle for existence more or less keen with other species, according to Darwin's experiments, predispose to perpetuate any hereditary modifications. In every case, facts should first be established by more varied and prolonged observation than ours, and then perhaps the explanations, now somewhat problematical, may follow.

The diversities depending on differences of origin exhibited by our experiments show differences in the modes of development without offering new specific types, or, at the best, only variations. These modifications are of the class known as physiological. But there is no necessity to play upon words. Every phenomenon must have a causes. If vegetation is more forward or more vigorous in one species than in others subject to the same conditions, there must be in its organisation some difference as yet unknown to us, for the same causes will not produce dissimilar effects unless applied to bodies more or less dissimilar. Thus when the action of light, of gas, &c., produces different effects on plants of the same external form growing side by side, we may be sure that the mode of penetration, of dissemination of these agents in the tissues, the transformations thence arising are different, which supposes natural differences of organization, although such differences may have escaped our notice. Visible types, external or internal, are the basis of our ordinary methods of classification. Differences of form, invisible perhaps, even with the microscope, owing to their minuteness, or which, if visible, have escaped our notice, produce

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*This diversity in the seeds and young seedlings of *Sisymbrium officinal* suggests that in some species of plants cases of *dimorphism* or *trimorphism* occur in other organs besides the flowers, analogous to those observed in the floral organs of dioecious and other species, with which Mr. Darwin's observations have rendered us familiar.

the differences of vegetation in question and produce those "physiological groups" of which I lately spoke, and which are nothing more than *known effects of unknown organic causes.*

Having thus connected physiological differences with differences of form, it may not be superfluous to add that our knowledge is at precisely the point in regard of the origin of primordial or successive changes in both. The origin of a physiological modification is at present as obscure as that of a morphological modification. The determining causes are very difficult to indicate with any degree of probability, and still more difficult to define in a direct and exact manner. It must be admitted of the successive diversities throughout the whole of nature, that the time of advent and, above all, the origin of each are involved in complete obscurity.

We recognise the fact that natural selection acts in the sense of preventing or perpetuating modifications, but it does not account for the occurrence of such modifications. As regards physiological diversities, one thing is certain, they can only have arisen in the course of a very long period of time. Physical and astronomical considerations prove beyond dispute that our earth was hotter in former ages, when plant-life already existed upon it. As a plant, and above all a plant of complex organisation, supposes the existence of an anterior plant, so it is obvious that the plants now existing in cold and temperate latitudes must have had ancestors living under temperatures which would be fatal to their descendants.

Precisely the same may be said of the succession of typical forms. They, too, have varied from age to age. This is not a theortical supposition, but a proven fact, as the study of fossil forms show us. But the sequence of these forms, their modes of evolution and proximate causes are still within the domain of probabilities and conjectures.

When, therefore, I picture to myself a modern naturalist committed to the demonstration, before a mixed assembly of mathematicians, chemists, physicians, &c., of tangible proofs of the transformation of animals or plants, I feel confident of his embarrassment. Other naturalists, wedded to old theories, will raise a host of objections, and he will be bound to admit in the end that his evidences do not amount to proofs. Then he will be able to reflect on the incontrovertible fact of the sequence of faunas and floras over the whole face of the globe, and may be permitted to turn upon his critics with the retort

"E. PUR SE UMOVE."

JUTE AND ITS CULTURE.

JUTE is a fibre which forms a very important article of commerce chiefly between India and Great Britain, though much finds its way to America, France, and other countries. The fibre is not so harsh as hemp, nor, except in rare instances, so soft as silk. It grows like reeds, throwing out small, lateral branches only, and sometimes, in good soil attains a great height, reaching occasionally, as much as eighteen or twenty feet, thought it generally ranges from four or five to about fifteen feet, The best kinds of jute have a clear, slightly golden tinge, and the fibre, though soft, is remarkable for strength, and in judging the different kinds, three qualities are taken into consideration, *viz.* length, strength of fibre, and colour. In England, jute grows very long with a strong fibre ; it is generally of a greyish colour, which would prevent the article from being placed among the first or even second qualities. A dull white colour is also objectionable, because, as a rule, jute of that colour is not strong , but if the white be glossy instead of dull, it will be found to have rather a strong fibre, and may often be placed among what by some assorters and screwers would be considered second quality. It is a difficult, matter, however, to speak of assortments of jute to those uninitiated, in a manner sufficiently clear to be easily understood, there being almost as many kind of assortments as there are screwers. Each screwer when commencing business, arranges an assortment of his own, and makes his *employés* always work on the same principle, not caring whether his assortment agrees with that of Messrs. A. and B. or that of C. D. ; and No. 4 of one party may be precisely the same kind of article as No. 2 of another. The better kinds, however, are distinctive in their characteristics, possessing strength of fibre and brightness of colour—great length increasing the value when conjoined with the former two qualities. The best description of soil for the growth of jute is a good loam mixed with a little sand, rather moist but not too wet. The land should be well cultivated, and prepared for sowing with as much care as for the growing of the better kinds of rice. The seed should be sown just after a shower of rain, in the latter end of March or the beginning of April, and in the proportion of about eight seers per bigah of land measured by the old Company's bigah. When the plant is about fifteen inches high, a good shower would be of great benefit to the crop. Of course, as usual with other crops, the lands should be slightly harrowed as soon as the seed has been sown. About three or four days after the plant has shown itself, it should be thoroughly weeded, and this process of weeding should be repeated when the jute has attained a height of fifteen to eighteen inches, but no thinning of the plant will be needed. After this, the crop will require no further attention until it is fit to cut, which, in this vicinity will be some time in July or the beginning of August. Latterly, the cultivators have taken to cutting jute much earlier than in previous years, in order to get the produce early to market and obtain the high prices which generally rule at the commencement of the season. Cutting the plant so early, however, is in our opinion, one of the causes of the great falling off in quality observable in the commodity of late years. When the proper time for using the sickle has arrived, which is earlier in some districts than in others, the plant should be cut two to three inches from the ground, or tied on small bundles for the convenience of steeping, taking care that it is not broken in the stalk in any way. The bundles should then be steeped (in clean water, if possible) and left for a week or ten days, after which they are opened, and the operator, taking as many of the reeds as he can conveniently hold by the top, or thin end, should agitate them in the water as much as possible, by which means the glutinous portion of the bark is entirely washed away, leaving in the man's hand a bunch of reed piths, each one of which is encased in a covering of fibre. By adroitly pushing the pith heart of the reed from the top towards the bottom, that is, away from the operator's hand and continually shaking the whole in the water, the fibre gradually slips off the pith and forms a strand of the same length as the original plant. The fibre should then be thoroughly washed and dried in the sun, when it will be ready for sale and become the article of commerce known under the name of jute, and of which, thousands and tens of thousands of tons are annually exported from this country.—*Bengal Times.*

COTTON IN THE MADRAS PRESIDENCY.

THE Madras Board of Revenue have submitted their Report on the cultivation of, and trade in cotton for Fasli 1286. The principal cotton-producing districts are Bellary, Tinnevelly, Kurnool, Kristna, Coimbatore, Madura and Cuddapah, and in these except in parts of Kistna, the season was most unfavourable for cotton as for other crops. There was a large diminution in the area of cultivation owing to deficiency of rainfall during the cultivation season, and the crop failed altogether in many places. The yield, where there was any, was deficient in quality as well as quantity. About one million of acres or one-seventeenth of the total area cultivated in the Government taluqs of the Presidency is usually under cotton, but in Fasli 1286 the area under cotton in Government taluqs was only 615,000 acres. The decrease in cotton cultivation is a great deal more than proportionate to that in the total extent of cultivation, which is owing to the season being peculiarly bad in the cotton-growing districts. The subjoined statement shows the particulars of cultivation in each district :—

Districts.	Fasli 1281	Fasli 1285.	Fasli 1286.	Percentage of Increase or Decrease in Fasli 1286, compared with the cultivation of Fasli 1285.
	Acres.	Acres.	Acres.	— 88
1. Bellary .	337,550	385,596	44,713	— 24
2. Tinnevelley ...	248,622	281,509	213,492	— 65
3. Kurnool ...	202,613	244,130	85,026	— 8
4. Kistna ...	226,414	229,583	211,619	— 24
5. Coimbatore ...	193,464	184,520	140 393	— 22
6. Madura ...	97,412	95,429	73,937	— 59
7. Cuddapah ...	75,952	85,701	34,286	— 14
8. Trichinopoly	49,540	43,186	37,228	— 65
9. Nellore ...	20,594	22,303	7,708	— 43
10. South Arcot ...	18,669	16 442	9,407	+ 32
11. Godavery ...	17,026	14,265	18,873	+ 57
12. Vizagapatam ...	16,653	12,900	20,303	+ 5
13. Ganjam ...	11,085	12,675	13,288	— 9
14. Salem ...	20,999	12,630	11,507	— 2
15. Tanjore ...	4,391	4,060	3,965	— 18
16. North Arcot ...	210	263	214	
17. South Canara ...	161	134	153	+ 14
18. Chingleput . .	5	3	3	...
Total .	1,557,363	1,645,389	926,115	— 43·7
Government Tracts ...	1,008,869	1,045,406	614,850	...
Inam Tracts ...	357,145	399,095	160,640	...
Zemindari Tracts ...	211,349	200,888	150,625	...

The cotton grown during the year in all the districts excep Coimbatore was indigenous. In the latter acclimatized Bourbont and American species were also cultivated. Experimental cultivation of New Orleans cotton was attempted in the Namkal taluq of the Salem district, but the result was as in the previous year a failure. In the indigenous cotton under cultivation there are several varieties. Some are of a pure white and some of a dull white color. Some have large leaves and pods of greater size than others, and the fibres of some are supposed to be stronger and the cloth made of them to wear longer than that made of others. The Collector of Cuddapah considers it highly probable that the seed cultivated in his district was originally brought from the cotton-growing districts of Bombay.

INDIAN FIBRES AS A SOURCE OF REVENUE.

A PAMPHLET with the taking title of "A New Source of Revenue for India," has been published by Mr. C. W. Strettell, a subordinate of the Forest Department. His readers are not long left to wonder what subject is to be discussed under cover of this vague and ambitious designation; for he tells them in the preface that his object is to advocate the cultivation by Government of certain plants which he conceives might be utilized in the manufacture of paper, and the importation into India of the machinery necessary to extract the fibre for this purpose. * * * * * * *

Mr. Strettell begins by traversing Mr. Routledge's well-known views on the subject of the cultivation of bamboo as a fibre-yielding plant which may be extensively utilized in the manufacture of paper. "Having the interest of India at heart," Mr. Strettell will "be agreeably surprised if, after careful inquiry, Mr. Routledge's proposition proves to be practicable." He is courteous enough to add, "I may, of course, be wrong, and Mr. Routledge right." *It is difficult to conceive how Mr. Strettell could be wrong*; but for the sake of argument, we may admit the possibility. It by no means follows however, that Mr. Routledge is right. The fact is that there is a striking resemblance between these two gentlemen, the difference being that Mr. Routledge's prevailing idea is bamboo, while Mr. Strettell is afflicted with *calotropis gigantea*. There can be, and is, no doubt whatever, that Mr. Routledge's plan of manufacturing paper from bamboo is perfectly practicable. That he has performed the process is a sufficient proof that it can be done. Kitchen tables may be made of mahogany or rosewood; and on the same principle, the immensely valuable bamboo may be converted, contrary to nature, to a use for which it was never intended. It may be exported at great cost for the manufacture of paper, instead of being used, almost free of cost, by the natives of India as the material of their dwellings and furniture. Its price may thus be raised so as to place it beyond the reach of those to whom it is a necessity; and while the revenue of the country may be increased by a commerce in bamboo, the poorer classes may be still further impoverished. Mr. Strettell seems to perceive this; but of course he cannot be expected to admit the force of the precisely analogous arguments which tell against the use of his pet fibres. He sees "nothing to prevent the successful introduction into the market" of *Broussonetia papyrifera* as a paper material. Yet almost in the same breath he tells us that "the leaves of this plant afford good food for some of the silk-worm family." The question will probably occur to practical people, why use a tree for paper-manufacture when it can be utilized in sericulture? The desirability of destroying the *Broussonetia papyrifera* by stripping off its inner bark for paper material, when its leaves can be employed as food for silk-worms, will probably not be apparent to any but a theorist whose mania is paper-making; more especially since £12 a ton is the most that could be expected for the fibre obtained from the bark, when used in the manufacture of paper, while Rs. 600 a year would be a fair average outturn from an acre of silk-worm food. Similarly—though of this fact Mr. Strettell does not seem to be aware—the fibre of the *calotropis gigantea* is already extensively and most profitably used as an adulterant of Tusser silk, and its employment for this purpose is infinitely more remunerative than its use as a material for paper could possibly be.

Mr. Strettell claims to have had nineteen years' experience in the Forest Department, and to have devoted much attention to the special subject of which he now writes. We have a right, therefore, to expect that his statements shall be supported by a reference to chapter and verse, and verified by allusions to experiments that have actually been performed, either by himself or by previous investigators. He is keenly alive, where the theories of others are concerned, to the unfairness and impolicy of recommending Government to embark extensively in an undertaking which has never really been tried before. On this point he remarks:—

"Before stating my own views, I propose to consider those contained in Mr. Routledge's pamphlet on bamboo, not with the object of detracting from his proposition, but rather to caution Government against engaging in an enterprise which may ultimately prove a financial failure as well as a political error. The ill-success which has attended many of our experiments, is in a great measure, I fear, to be attributed to a disregard of the old maxim 'Look before you leap'; and there is no doubt that the more important the project, the greater is the necessity for careful deliberation before embarking on it."

These very proper sentiments lead us to expect that he is about to unfold a plan, carefully fortified against mistake by plentiful illustrations from the experience which he professes to have gained. Yet, strange to say, the one striking characteristic of his pamphlet is the purely suppositious nature of its statements. By way of illustrating the utterly unpractical character of his recommendations, and enforcing the lesson of "Look before you leap," to which he himself attaches such importance, we have marked a few of the most glaring instances of the suppositions out of which he proposes to extract a large revenue for India.

Mr. Strettell admits that the cost of manufacturing the fibre is "estimated at from £60 to £70 per ton," but goes on to assert, without a shadow of proof, that by using a machine which he thinks ought to be made, but which has never been used in any form, the cost might be reduced to £7 per ton. On those rare occasions when he does appeal to experience, he generally misinterprets its reply. Thus, for instance, when he asserts that any one who has had practical experience in bamboo culture, must feel that the surest and cheapest method of reproducing it is by division of its roots," we are compelled to differ from him. Very extensive experiments in bamboo propagation were made a few years ago in the Surat district, on both salt and fresh land, with the result of convincing those who were concerned in them that propagation by seed is the only reliable and satisfactory method. Unless there is abundance of rain, the divided roots speedily die. Mr. Strettell himself indirectly admits this; for after deliberately asserting, as an incontrovertible fact, that root propagation is the surest and cheapest mode, he goes on to observe:—

"For these reasons it will not *always* be convenient or profitable to cultivate bamboo from seed, and I have therefore proposed—*when practicable*—to propagate the plant by division of its roots."

Again, the five plants out of whose fibre Mr. Strettell has been able to make paper include three varieties of the *ficus* (we presume he means the *Eurostygma*). Of these he asserts that:—

"These boughs are simply *stuck* in the ground, and within twelve months they become, without any further care or attention, well-established, handsome young trees. In Burma, many of the roads are avenued with this wide-spreading tree, whose dense foliage renders it peculiarly suited for the purpose."

The first sentence is surely an unintentional exaggeration; for we have always believed that those trees required to be regularly watered. But it is for the sake of the concluding admission that we have quoted this passage. After asserting that simply because the timber of these trees cannot be utilized, their being used for paper will be tantamount to a conversion of an otherwise valueless tree into a source of revenue, he incidentally admits, without perceiving how the admission militates against his conclusions, that they are admirable avenue-trees. He goes on to suggest naively that "when this material is being tried, consignments of *half-stock* be imported," in order, doubtless, to save the cost of freight on the raw material. Of course, he does not think it worth mentioning that the reduction of the fibre to this stage involves the use of most expensive machinery, which, if his proposal is to be carried into effect, it will be necessary for Government to introduce into this country, simply to carry out an experiment for the successful conduct of which he possesses no data. In the next paragraph, Mr. Strettell declares his inability to compute the cost of producing fibre from another of his favourite plants, and says, "all I can do at present is to recommend it to fair trial." This is practical with a vengeance!

It is, however, when he approaches the discussion of the claims of the *calotropis gigantea* that his assumptions begin to multiply. He has not made paper out of this fibre, nor, so far as he tells us, has he ever heard of any one else doing *so*; but, nevertheless, he is satisfied that paper could easily and profitably be made from it. Fortunately, however, the *calotropis gigantea* is a tree whose acquaintance we have not now to make for the first time, and the results of experiments which have been extensively tried, go to disprove Mr. Strettell's suppositions. The first of these appears on the very threshold of his statement.

"The method of disengaging the fibre, as compared with the elaborate processes attending the separation of all others,—including jute, bamboo flax, hemp, &c.—is so simple, that the plant merits careful notice, as much on grounds of economy as in consideration of the valuable quality of its fibre."

On the contrary, as Mr. Strettell would find if he attempted to reduce his theories to practice, the extraction of the *calotropis* fibre is a most difficult and tedious operation; and the comparison instituted between this process of extraction, and that used in the other industries which he mentions, makes his statement ridiculous. The extraction of the jute fibre is of the simplest possible character; but to take another process not quite so easy, we may mention that one man will extract 30lb. a day of brown hemp fibre, while the amount which can be extracted from *calotropis gigantea* may be reckoned by ounces.

Mr. Strettell goes on to describe the kind of machinery with which he proposes to simplify still further what, with him, is at the worst an easy process. And it is here, as we should expect, that he goes farthest astray. His description is evidently borrowed from an indistinct recollection of a flax-scutching machine, and the board which he would employ in packing for export is, as nearly as possible, a scutching block. The striking of the fibre "with a flat wooden sword" is simply hand-scutching. Now, not to mention the expense of scutching machinery, which is very considerable, we may say that scutching is no practised, and to the best of our belief, cannot be practised, with *calotropis gigantea*. The fibre is extracted by very careful scraping with a wooden knife; the reason being the shortness of the internodes, which render anything like scutching well nigh impossible.

We might easily multiply examples of the inaccuracies and errors into which Mr. Strettell has fallen; but we end with a crucial instance:—

"One acre stocked with plants 4 x 4 would equal 2,704 plants; which will yield 582 pounds of *bonâ fide* fibre under the present rude system of preparing it; or 727 pounds under a more economical process, the waste in converting the stalks into fibre being 25 per cent."

The only meaning which these words are capable of bearing is that three-fourths of the *stalks* may be used as paper material. This is, of course, incredible, and is quite inconsistent with the statement of fact which occurs in a quotation from some unnamed author on page 28:—

"At present the *calotropis* bark is too dry and woody; it will not strip at all; or if any portion comes off, the fibre is scanty and very short. That sent you is about arm's length. The season for collecting the fibre is when the fiber is soft, and the bark comes off clean and easily."

It is, of course, only the bark which is used. As a most extreme case, we may suppose that the bark occupies twenty per cent. of the whole stalk' and that ten per cent. of the bark may be converted into fibre. This gives the quantity of fibre available for paper manufacture as two per cent. of the whole. Yet we are assured that "the waste in converting the stalks into fibre is only 25 per cent.," a statement which is quite in keeping with the general tenor of the pamphlet in which it occurs.—*Madras Mail.*

GARDEN.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Thursday the 21th October, 1878.

S. H. ROBINSON, ESQ., Vice-President, in the Chair.

THE proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

Messrs. James Caldwell, A. W. N. Wyatt, Robins Cooke, and Shaikh Ahmed Ali.

The names of the following gentlemen were submitted as desirous of joining the Society :—

The Superintendent of the Botanical Gardens, Saharunpore,—proposed by Mr. E. Buck, seconded by the Secretary.

Charles Roberts, Esq., Kurseong, Darjeeling,—proposed by Mr. G. L. Kemp, seconded by Mr. S. H. Robinson.

Manager Noohabaree Tea Estate, Assam,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

Manager of the Punkabarree Tea Co., Punkabarree,—proposed by Mr. Kemp, seconded by Mr. J. E. Maclachlan.

CONTRIBUTIONS.

1. The Indian Forester, July 1878. From the Editor.
2. Annual Report of the Supt. of Govt. Farms, Madras Presidency, for year ending March 1877. From the Superintendent.
3. Memoirs of the Geological Survey of India, Vol. XV., Part I. From the Director.
4. Report on the Royal Botanic Gardens, Kew, 1877. From the Director.
5. A further supply of Reana seed and some Maize seed, raised from American stock. From Dr. Lynch. These cobs of maize are nearly equal in size to the original stock.
6. Seeds of *Kentia Wendlandtiana and Eucalyptus Baileyi.* From L. A. Bernays, Esq., V. P. Queensland, Acclimatisation Society. Mr. Bernays states that this is a new *Eucalyptus*, lately found in the Brisbane district in hot dry situations, and in recognition of its discoverer it has been called E. Baileyi.
7. Seed of the Falkland Island Tussack Grass (*Dactylis cæspitosa.*) From Baron Ferd. von Mueller.

"I got the seeds," observes the Baron, "from Sir Joseph Hooker, who procured it from the Shetland Islands. Of course it would only be adapted for the *Alpine* country of India."

8. A few seeds of the "Akee" (*Blighia sapida*) raised in the Cawnpore Government Farm. From the Director Agriculture, &c., N.-W. P.

HORTICULTURAL EXHIBITION.

A recommendation was submitted from the Council that the next show of vegetables, fruits and flowers be held the last week of January 1878, due notice of details being given in the early part of that month. Agreed to.

GARDEN.

The following report from the Head Gardener was read:—

"The work during the past month has been chiefly potting off the young stock. Coolies were quite as active as last month cutting grass and cleaning up the garden, as the late close and showery weather has been highly conducive to the growth of weeds. An extension of the old plant sheds has been made so as to embrace the propagating beds under partial shade and thereby give facilities for increasing stock. Many pans of various Palm seedlings, which had been lying by, were potted off early in the month. The collection of Australian seeds sown on 28th August have, up to the present, shown little signs of germination; I am afraid the seed must have been old. The Palm seeds from Mauritius, sown same date, have partly shewn themselves. The seeds of *Pithecolobium saman* from Royal Botanic Gardens at Howrah, sown on 13th September, germinated, and have been potted off. Of Liberian coffee seeds, three batches have been sown. The first lot were sown on 28th August and germinated on 27th September, but the cotyledons of several have not yet freed themselves from the integuments of the seeds; some cuttings of the same which I put down about three months ago, are still alive and green and slightly growing, but have simply formed a large white 'callus' at base, without the trace of a root as yet. The trial sowings of imported seeds were commenced a few days ago; the percentage of germination will be given early. I herewith forward two flowers of *Hibiscus rosa sinensis miniatus semi-plenus*; the semi-double appearance is produced by a petaloid condition of the staminal filiments, which are broken up into several parcels instead of being monadelphous. These flowers are difficult to secure in a perfect state, for as soon as as they open an orange and black barred beetle "Mylabris Cicherii" attacks them. It seems to be particularly fond of this semi-double Hibiscus, as the large single flowers of the other 'Hibisci' near at hand are untouched by them."

HORTICULTURAL NOTES.

Read the following extracts of letters from Col. W. H. Lowther, Benares :—

September 23rd.—"The damp is excessive, and I have lost nearly all my early sowings of Cauliflower and the Cabbage tribes, but Endive and Celery are fine beyond all expectation. Most rainy season flowers *poor*, especially Amaranthus and Balsam, excessive rain has damaged their growth: such rains have not visited Benares for ten years. Every promise of a good harvest, from hence to Bombay I hear the same account. Just the year for "Lucerne" and "Reana luxurians" where previous irrigation was available. I lost my field of "Lucerne" in those torrid months of June and July, my well having run dry, but some plots near water supply have been so prolific, since the rainfall that they give perpetual cutting, and I find them ample for three horses up to date."

October 12th.—"I hoped to have sent some novelties, most of which have been destroyed by the late hot months; though the nights have commenced to be cool, yet the temperature by day is far above that of October last year by many degrees, yet snow was seen on the Hindu Kosh in August, the earliest within the memory of any European in India, and we may have a long and severe winter in the North-West, producing a good cold season here in the lower Provinces. Benares was never so healthy to Europeans as in 1878, only one death by cholera and two casualities by fever among British troops. I think the amount of wind, (almost daily breezes in the whole twelve months) is the source of our sanitary condition. Can you spare me a pinch of *Reana luxurians* seed, my few plants are too young to bear any in this year, they were given to me rather too late in the rains for quick growth.

"The crops are wonderful here. I never saw such tall *bajerow* before September's daily showers and sunshine did the work; it was the finest month in our year for agriculturists and gardeners, and tolerably cool.

"I gave half my *Reana luxurians* to the Rajah of Benares, with a strong recommendation to cover his lands with this crop, and of the remainder I gave part to a gentleman who is greatly interested in fodder plants.

"My Guinea grass I have dug out and burnt, for I nearly lost a fine bullock to which an over-quantity was given, and many years ago I had a large spotted deer killed by getting at a field of this grass during the night; and now being afraid of its effects on valuable horses, I have thought it prudent to get rid of this boasted forage."

Letters were read—

From the Department of Agriculture and Commerce, Govt. of India, forwarding certain papers connected with the introduction of the Arabian Date Palm into Oudh. (Transferred for Journal.)

From the same, requiring a quantity of hybrid Tea seed from Assam, for cultivation in the Arracan Hill tracts. (To be complied with).

From the Director of Agriculture, N.-W. P. requesting that a quantity of Alpine Oats be imported for Government. (To be attended to.)

From Messrs. Ede and Hobson, Agents for Messrs. Ohlendorff and Co., submitting a copy of Messrs. Ohlendorf's pamphlet on Guano, and offering a certain quantity for trial and report. Accepted.

From Major Protheroe, Port Blair, Andamans, applying for a quantity of native vegetable seeds for the island. [Complied with partially through the kind assistance of Dr. Lynch]. Major Protheroe adds: "You will be glad to hear that the tea plantation is thriving. We have about fifteen bigahs under tea, quite enough to determine whether the experiment will succeed. The plants which were put out in March are growing vigorously, and I have great hopes of our ultimate success."

AGRI.-HORTICULTURAL SOCIETY OF MADRAS.

PROCEEDINGS of a Meeting of the Committee of the Agri-Horticultural Society of Madras, held at the Gardens on Wednesday, the 7th November 1877.

PRESENT:—

General T. Raikes, C. B., *in the Chair.*

Surg. Major G. Bidie, M.B., F.L.S.
The Hon'ble J. G. Coleman.
Col. A. T. Searle.
Joseph Steavenson, Esq.
W. W. Munsie, Esq.
John Shaw, Esq., *Hony. Secy.*

The Proceedings of last Meeting were submitted and confirmed.

The Honorary Secretory then intimated that the following contributions, had been made to the gardens, and a vote of thanks was passed to the donors.

Seeds of *Kentia Wendlandtiana* from L. A. Bernays, Esq., Vice-President of the Queensland Acclimatisation Society.

Forty carob seedlings from the Board of Revenue through C. Benson Esq., Superintendent, Experimental Farm, Sydapet.

A bundle of plantain fibres from a coarse variety of plantains recognized, by the local name of "Ottinum" on the Javady Hills in the Salem District from Dr. Shortt.

Seeds of Barklya syringifolia, Stenocarpus cunninghami, Owenia cerasifolia, Tristania verufolia, Buckinghamia celcessima, and Nelumbium sachhardlii, the latter a large and very beautiful lily, from Walter Hill, Esq., Director of the Botanic Garden, Brisbane.

A collection of Australian seeds from Dr. R. Schomburgh, Director of the Botanic Gardens, Adelaide.

1. Read letter from J. Kurz, Esq., dated Royal Botanical Gardens, Calcutta, 3rd August 1877, asking for information about the plantains grown in Madras and other places of the Presidency, to assist him in the preparation of a paper on the Musaceæ of India; letter from Dr. Shortt, dated Camp Erroad, 2nd October 1877, forwarding a paper on the plantains of Southern India, with thirteen drawings showing varieties of fruits plants, &c., and letter from Mr. Kurz, dated Royal Botanical Gardens, 22nd October 1877, returning Dr. Shortt's paper.

Resolved, that Mr. Kurz be given every assistance in the Society's power, and that Dr. Shortt be thanked for his interesting communication which will be printed with these proceedings.

II. Read the following letter from R. Gaitskell, Esq., dated Charity Estate, Vythery, 28th September 1877 :—

"I beg to enclose an extract from the *Madras Times* regarding a new grass plant which I should think would thrive very well indeed on these Hills (S. Wynaad). If you could procure or send me a few seeds or plants I should be very much obliged. I should say that the grass might be propagated readily by division of the roots.

"In connection with the Gardener's report on Reana luxurians, the Secretary of the Calcutta Agri-Horticultural Society, at a recent meeting, called attention to several more letters he had received since last meeting, regarding this fine grass. Dr. R. C. Sanders, of Azimgurh, writes as follows :—

"'The 18 seeds of Reana luxurians sent me some months ago all germinated, and have grown most freely ; each seed was put in at intervals of 5 feet, but some two months back each plant had so spread that all touched, some have from 100 to 120 shoots. To give air to those plants which I wished to seed, I had some of the plants cut nearly to the ground ; cattle eat what was cut most greedily both in its fresh state and also when dry ; and the plants which were cut instantly grew again and are now fit to cut afresh. It is a most excellent grass, and will, I think, be well suited to the country.

"'The plants have had the advantage of the Jail Garden, which includes a very rich soil and abundance of water, otherwise they could not have made such growth in the hot weather ; so far there is no appearance of any blossoming, though the plants which have not come out are seven feet high. Should they seed I will send the produce to you.

"'I should be glad if you could send me a few more seeds for rain sowing and also some to give away ; I have had many applications for seeds and plants. I have at the same time been trying 'Prickly comfrey,' it is a miserable failure compared to Reana.

"'Mr. Patrick Duff, of Senerah, Bhaugulpore, also reports most favourably. He remarks ;—'The Reana luxurians has grown 9 feet high, and I have found cattle devour it greedily. When I cut it down I leave a little leaf on the stalks, and this is also springing up very nicely. Is it only an annual, or can I keep it standing without fear of its dying off in the cold weather ? I persume it will produce seed, and that this will answer for next year's crop. The natives say they know it grows here, but I think they must be mistaken as they have not produced any thing like it when asked to do so.'

"In a subsequent letter he adds—'that he has tried this grass for feeding elephants, and finds that they take to it at once, and it would be very valuable fodder for them during the hot months.'

"Mr. Blandford, of Turtipore, Malda District, likewise bears witness to his success with this grass, and promises further and fuller particulars hereafter."

Resolved, that Dr. King, of the Royal Botanical Garden, Howrah, be requested to send the Society some seeds or plants of Reana luxurians. It is a Mexican annual grass, belonging to the Section Phalaridæ, of which we have no Indian representatives except the several species of Coix, *Job's tears*. Several European grasses, such as Alopacurus and Phleum, however, belong to the same section of Gramineæ. The Committee think that cholum would probably be found an equally good if not better fodder plant. There is always a craving for new things, to the not infrequent neglect of the superior old.

III. Read communication from the Board of Revenue, dated 19th October 1877, that the whole consignment of plants of *Ceara Eaoutchouc* and *Copaiba balsam* intended for Madras was to be sent to the Conservator of Forests, who had been requested to arrange for their speedy distribution.

Resolved, that the Conservator of Forests be requested to send the Society a dozen of each of the above mentioned plants.

IV. Read the following letter from Dr. Shortt, dated Madras, 23rd October 1877.

"I have the honor to request you will do me the favour of laying the following subject before the Society for their decision :—

On applying to the writer at the gardens the other day for a packet of seeds, he was good enough to send me the enclosed note and copy of rules, informing me that I am not entitled to seeds or plants from the garden as an "Honorary Member."

This seems to me a strange theory to propound, and whilst I beg to thank the Society for their kindness in having elected me an "Honorary Member," I submit, as is usual with other Societies, that I am entitled to the same privilages as that of ordinary members, nor can I find any thing to the contrary in the copy of the rules sent me with the note alluded to above.

My case is exceptional, not one of the honorary members reside in India, nor can I at present tell what my future movements may be. It was an accident that detained me in the service after my disconnection with the Society ; this will however terminate I believe at the end of the year.

But I think the question is one that deserves consideration from the Society as to the privileges of honorary members, and should be definitely decided one way or the other. It seems strange that extraordinary members be granted the privilege of ordinary members, which should be denied to honorary members? To me it appears from a perusal of the Rules that it was not required to define exactly the position of honorary members, but that as regards extraordinary members it was necessary to define their rights, and this is explicitly stated in the Rules. Under these circumstances I should be glad to have the decision of the Society on the subject.

At the same time I beg to state that owing to your kindness I have had almost every thing in the shape of plants that I asked for, but as the question has been mooted, I think a definite decision should be arrived at on the subject once for all."

Resolved, that Dr. Shortt be informed that it has always been understood that honorary members are not entitled to the advantages of the Society without payment of subscription, and that the Committee do not consider any alteration desirable.

V. Read the following extract from the *Medical Press and Circular* of the 10th October 1877, forwarded to Dr. Bidie, by Messrs. Calvert and Co.

"THE RAIN TREE.

The United States' Consul at Columbia, in the Department of Loreto, sends home some curious details of a tree which exists in the forests close to the town of Mogobamba. It is about 50 feet high when at its full development, and its diameter at the foot of the trunk is about three feet. The tree is stated to absorb and condense the humidity of the atmosphere with astonishing energy, and it is said that the water may frequently be seen to ooze from the trunk and fall in rain from its branches in such quantity that the ground beneath is converted into a perfect swamp. The tree is said to possess this property in the highest degree during the summer season principally, when the rivers are low and water is scarce, and the Consul, therefore, suggests that the tree should be planted in the arid regions of Peru, for the benefit of the farmers there."

Resolved, that the copy of the extract be forwarded to Kew with a request that the authorities there will be good enough to afford any information they may possess regarding the tree, and furnish a supply of seeds or plants if available.

VI. Resolved, that as P. Vencatachella Cheety, Esq., has been absent from all the Meetings of this Committee since its appointment in March last, he shall be deemed to have vacated his seat under Rule 15, and that the Hon'ble Mr. Justice Kernan be requested to take his place.

The financial statement for November was laid on the table, and the estimated expenditure of Rs. 500 for October was sanctioned.

The excess of expenditure over the estimate for last month is owing to payments having been made on account of members and some other charges which will be recovered.

FINANCIAL STATEMENT FOR OCTOBER 1877.

	Rs.	A.	P.
Cash balance on 30th September 1877 ...	1	7	0
Received from Secretary	619	5	4
Rupees ...	620	12	4
EXPENSES—			
Fixed Establishment	169	0	0
Other expenses	260	7	4
Rice purchases for gardeners	190	2	0
Cash balance on 31st October 1877	1	3	0
Rupees ...	620	12	4
Actual balance to the credit of the Society's account on 30th September 1877	690	11	0
Revenue during the month of October 1877, paid to Messrs. Binny & Co.	923	1	4
Rupees ...	1,613	12	4
Drawn in October 1877	619	5	4
Actual balance to the credit of the Society's account on 31st October 1877	994	7	0
Rupees ...	1,613	12	4

THOMAS RAIKES, *Chairman.*
JOHN SHAW, *Hony. Secretary.*

THE MUSACEÆ OR PLANTAIN ORDER.

BY JOHN SHORTT, M. D., F. L. S., &C.
Surgeon Major, Madras Army.

Musa paradisiaca, Linn.—Plaintains, Herbaceous. Stem simple, thickly clothed with the sheathing petioles of the leaves : leaves forming a tuft on the apex of the stem ; spike of flowers compound rising from the apex of the stem : each division enclosed in a large spathe with *male* flowers at the base : *female* or hermaphrodite ones at the upper end : perianth with six superior divisions, five of which are grown together into a tube, slit at the back, the 6th is small and concave : style short : fruit oblong, fleshy, obscurely 3-5 cornered with numerous seeds buried in pulp : flowers yellowish-whitish. *Drury.*

The Musa paradisiaca, popularly known as the plantain, is derived from the Spanish word *Platano*. In Tamil it is called *Vallei* or *Vashei*, Telugu *Aritt*, and Hindustani *Maus* or *Kayla*. From the Hindustani term Maus the generic name Musa is believed to be derived.

There are several species of the plantain found growing in Southern India, and the following may be enumerated:—

1. Musa paradisiaca, or Plantain.
2. M. sapentium, or Banana.
3. M. Cavendishii, or Mauritius Plantain.
4. M. textiles, or Manilla Hemp.
5. M. suporba, or Hill Plantain.
6. M. rubra, or Red Plantain.
7. M. ensete, or Ornamental Plantain.
8. Heliconia buccinata, or Flowering Plantain.
9. Ravenala speciosa, or Traveller's tree.

The *Musa paradisiaca* is the most general. The natives enumerate a large number of varieties. I will only describe those that are well known and more generally met with in Southern India, with their Tamil names.

*a. Monthen**—This is a large and nearly straight fruit, generally about 9 inches in length and 5 to 8 in circumference. Color green, when ripe light yellow, the fruit is three or five sided and well ridged at each angle or side, the skin or rind is thick and fleshy. The fruit when ripe is sweet, but has no flavour, and is believed by the natives to possess cooling properties when eaten. The green fruits are carried to a large extent and also prepared into sweets with sugar. The Monthen plantain is well known from its size and form and readily recognized, and is met with in most districts. The tree attains the height of 15 to 20 feet.

b. Samai Monthen.—A variety of the above fruit, differing only in size, and averages about 6 inches in length. The green fruits are curried and the ripe eaten. The tree resembles the last in general form and height.

c. Ladam, synonymous with *Nadam.*—In this variety the fruit average about 6 inches in length, when ripe it has a greenish yellow color, although round it is ridged or slightly angled, its rind thick, but not quite so thick as that of the Monthen. The fruit is sweet, and the flesh has a very light straw color, scarcely observable at times, sometimes it has a mealy or cottony taste, and is generally cooked into curries and eaten when ripe. The tree attains from 12 to 15 feet in height.

d. Pachai Ladam.—In this variety the fruit greatly resembles that of the Ladam, is long and curved, and retains the greenish color even when ripe. It is believed to possess cooling properties. The green fruits are cooked into curries and the ripe eaten. The tree attains to 15 feet in height.

e. Rustali.—This variety is generally known as "table plantains." The fruits are round and slightly curved, and much esteemed as a fruit. It is not generally used for cooking, but only eaten when ripe, the rind is thin and the fruit becomes yellow as it ripens, and is of moderate thickness, averaging 6 inches in length and 4½ in circumference. The rind is often dotted with black spots, and portions of the pulp eats gritty owing to small nodules of hardened flesh or pulp having a rust colored tinge being invariably present, but the fruit is nevertheless sweet and tasty and much appreciated as a table fruit. The plants attain 15 to 18 feet in height.

f. Puvaly.—Popularly known as the "Guindy plantain," and considered the best variety; it is not used in cooking, the fruits are considered too valuable for such purposes, the average fruit is round and small sized, a good bunch may contain over 1,000 fruits, the taste of the ripe fruit is luscious and sweet with a most delicious flavour, the rind thin, almost as thin as paper. It is the best variety of plantain, and is always in request for the table.

g. Karuvalay.—The fruit of this variety is quite round and well-shaped, its color when ripe is dark green. The average length 6 inches and 4 to 5 inches in circumference. This is a wild variety, and is only found growing in jungles and hills, and its use is confined to the preparation of certain medicines. The fruit may be eaten when ripe, and the green fruits cooked into curries.

h. Rajavalay.—This variety is believed to be indigenous to Mysore, and introduced from thence into other districts. The fruit is yellow when ripe, averages 4½ inches in length and 3 in circumference, round with a thin rind, and is supposed to excel all other fruits in its flavor and taste, is always eaten ripe, seldom cooked into curries.

i. Anai Komban.—This is the largest, and a coarse fruited, wild variety, of plantain, the fruit being nearly 1½ feet in length, is seldom cultivated except as a curiosity. The color is light yellow, the rind thin. It is unfit for food, although sometimes the ripe fruit is eaten by the poor.

j. Aduku Valay.—This is a small fruited plantain, scarcely exceeding 2 or 3 inches in length, derives its name from the number of the fruits and the close manner in which they are "packed;" a good bunch contains upwards of 2,000 fruits. The fruit is round, sweet, and of a yellow color. The rind is thin, and the fruit eaten when ripe, but not used for cooking.

k. Kathali.—This variety is common to the Tinnevelly and Malabar districts. In Malabar it is abundant and considered sacred, used chiefly as offerings to deity. The fruit is tasteful and has a yellowish color. The size of the fruit varies from 3 to 4 inches in length, according to the nature of the soil on which it is grown, and about two inches in circumference. It is never used for curries, being considered too sacred for such purposes.

l. Nenthiramcoy.—This is a peculiar fruit and confined to Malabar, Travancore and Cochin. The size of the fruit is 16 inches in length and 6 inches in circumference. Slightly curved, pointed at both ends, 4 sided, well ridged on two and faintly ridged on the remaining two sides. Flesh salmon-coloured, rind thick. The fruits are extremely tasteful, and it is always preferred when procurable. The green fruits are curried and the ripe eaten.

m. Payan Valay.—In this variety the fruit is small and has some slight resemblance to the Monthen plantain; the color is of a greenish yellow, and the rind thick. It is believed to possess medical properties, and to cool the body, in consequence of which it is appreciated. The ripe fruits are eaten and green carried. It has a local name of *Sambirana* in the Salem district. The tree attains 15 to 20 feet in height.

2. *Musa sapientum* or *Banana*.*—I found a single plant growing in the Lal Bahg, Bangalore, of this species. Mr. Cameron, the Superintendent, tells me that the plant grows lofty and attains about 30 feet in height, and as far as I could see, I did not recognize any difference from the ordinary plantain.

3. *Musa Cavendishii (Chinensis).*—Commonly named the "Mauritius plantain." This is a dwarf species the plant grows robust and compact: by some it is believed to have been introduced from the Mauritius, by others from China. It is met with in most districts. I have seen it in the Northern as well as in the most of the Southern districts. The plant seldom exceeds five feet in height, frequently it is much under that height, very sturdy, with leaves overlapping each other closely; it thrives well in the plains (as well as in the hills, up to a height of 5,000 feet above sea-level. Is very productive, and produces an enormous bunch of fruits, when well grown, that pits or holes have to be dug to enable the bunch to descend below the level of the soil uninjured. Each fruit averages from 7 to 10 inches in length, is of uniform thickness, and ripens of a pea green color. The flesh or pulp has a straw color, having a resemblance to the color and flavor of the red plantain. It is sweet and well tasted, the rind moderately thick.

4. *Musa textilis* or *Manilla Hemp.*—The fruit of this species is small, resembling in general appearance that of the Rustali. It is not fit for food being filled with seeds, but Mr. Thompson, the Superintendent of the Governor's Garden at Guindy, tells me that the fruit contains some pulp which is sweet and well tasted. There are about half a dozen plants growing at Guindy, and the largest of these was 10 feet, but I believe it attains from 25 to 30 feet in height. It yields the finest and best kind of fibers which the natives do not utilize. A variety of this plaintain† has been imported into Southern India in consequence of its fibres, it has not met with general acceptance, as the fruit is considered worthless and not fit to eat. The absence of a machine, and the want of interest in the extraction of the fibres, causes it to be neglected.

5. *Musa Superba* or *Hill plantain*—This is the wild plantain, an ornamental and handsome plant when well grown. The stem is formed above soil and is exceedingly stout, strong and conical, exceeding 10 feet in circumference above the surface of the soil, where it is bulbous, and 5 feet at the summit immediately below the leaves. Leaves petioled, but not sheathing, is found in abundance about the hills in Travancore, Pulneys, South Canara, and other hill ranges up to a height of 5,000 feet above sea-level. I brought a number of bulbs in 1872 from the "Mukh in South Canara, and distributed them to the Madras Horticultural Gardens the Lal Bagh, Bangalore, and introduced it on the Shevaroy Hills, where I have at present a number of plants, two of which are in fruit now. In a couple of months, I hope to have an abundance of seeds for distribution.

The plant attains a height of from 10 to 20 feet, and is very handsome and showy. The flower stem rises perpendicularly and then curves down, the flower bud is large, much shorter and stouter than that of the common plantain, having the shape and form of a bullock's heart. The fruits form clusters around the peduncle like the ordinary plantain, the berry is oblong, and about the size of a duck's egg. Smooth and slightly ridged, three celled when ripe, nearly dry, having no pulp and filled with numerous black seeds, about the size of a small marble each. It is propagated from seed and suckers, the suckers are rare and occasional, and are not thrown up so plentifully as in the ordinary plantain. It is met with now about many gardens in Madras.

6. *Musa rubra*, or *Red plantain.*—This is a tall plant, attaining some 20 feet in height, and producing a dark red colored and rather large sized fruit, averaging from 7 to 10 inches in length and of a unifrom thickness: it is a very fine fruit with a rich flavor and buttery consistence. The plant is readily distinguishable from the dull red color that pervades every part. The fruit ripens of a yellowish red and is greatly appreciated, generally Europeans object to its strong flavor. It is grown about Madras and along the Eastern Coast, and is largely cultivated in the vicinity of Madras, more especially at the village of Voyalore for the Madras market, where it is always procurable. I have also seen it flourish at Combaconum in the Tanjore district. The fruit is generally eaten ripe and never cooked, as it is considered too valuable for such purposes, and is believed by the natives to possess cooling properties. The rind is thick and fleshy, and the pulp has a light straw color, peculiar flavor, and luscious taste, that is satiating.

7. *Musa ensete* or *Abyssinian plantain.*—A single young plant of this species is growing in the Lall Bagh, Bangalore. It is said to be the largest of all plantains and the finest for decorations, and in general appearance it resembles the Musa superba, except that it does not become bulbous at the base, and attains a much greater height. This plant was pointed out to me at the Lall Bagh, Bangalore, by Mr. Cameron, the Superintendent.

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* Synonymous with Bon then.

* Banana is a West Indian term.

† The true Manilla hemp.

8. *Heliconia buccinata.*—A small plant resembling the plantain and now common about Madras gardens as an ornamental plant. I have not seen it in flower.

Urania speciosa or *The Traveller's tree*—also known as the *Water tree*, is now found growing in many gardens about Madras, and it is particularly distinguished for the fan-shaped form the trees take from the spreading of their leaves and attaining the height of 20 to 30 feet. A tree in the Madras Horticultural Gardens is at present pushing out its flower spathe, and some trees in the Governor's Garden, Guindy, one in fruit, from whence I obtained the specimens. It is readily propagated from seeds, and I have the plant on the Shervaroy Hills. The fruit grows in clusters like the common plantain, in 4 inches long and 2 wide, flat, and slightly convex in the upper, and concave in the lower side, the lower edge sharp, and the upper half an inch wide, and ridged at the edges. It is covered with a thickish rind containing a canine tooth-shaped hard shell, within which there is a deep blue cottony substance in which the seeds are imbedded. The seeds are flat, concavo-convex, having one end slightly turned in.

Exclusive of the varieties named above, most districts have local names for the plantain. In a garden at Comalesperanpettah the other day the owner pointed out to me the following varieties that were growing there. 1. *Mnthen.* 2. *Pay Monthen.* 3. *Bengal.* 4. *Mauritius.* 5. *Guindy.* 6. *Rusthali.* 7. *Chukrakahly.* 8. *Ootheroo.* 9. *Red.* 10. *Kurry.* 11. *Musa superba.*

In the Tinnevelly district the following varieties are said to exist. 1. *Tholuvam Valay.* 2. *Kalkathali Valay.* 3. *Punllatchum Valay.* 4. *Nalkathali Valay.* 5. *Atham Valay,* 6. *Payam Valay.*

In the Salem district. 1. *Puthemanthu Valay.* 2. *Pee Valay.* 3. *Sivala.* 4. *Payan Valay.* 5. *Putcha Valay.* 6. *Woothira Valay.* 7. *Vunwangoy.*

In the Madura District. 1. *Purpuram Valay.* 2. *Attucomben Valay.* 3. *Namaram Valay.* 4. *Malai Valay.* 5. *Mail Valay.* 6. *Vayal Valay.* 7. *Poolachoondum Malay.* 8. *Mambal Palay* 9. *Mellai Palay,*

In the Lower Pulneys. 1. *Navarumpalam.* 2. *Poovampalam.* 3. *Puchaipalam.* 4. *Pulvarumpalam.* 5. *Attucombenpalam.* 6. *Sedanpalam.*

The size of a plantain is no criterion of its being a variety, for under vigorous cultivation the size and flavor of the fruit changes wonderfully. I have seen the small Guindy plantain grown in a grass farm at Kilpauk, Madras, under the stimulus of night-soil from the European barracks in the Fort, attain almost the size of a red plantain, averaging 7 to 10 inches in length, that it was difficult to recognize the fruit from its size and flavor. The same may be said of all varieties of the plantain.

The plantain grows in every part of India, and from about [illegible] to 6,000 feet above sea-level, the fruits are greatly esteemed by all classes for its easy cultivation and large produce, furnishing good, healthy, nutritious food. Its value is enhanced when it is known that every part of the plantain tree can be utilized. The roots and sap or juice is used in medicine, the sap possesses astringent properties from the tannic acid it contains, and has been used as a substitute for marking ink. It stains cloth a dark color, which it is difficult to wash out.

The under-ground stem, the tender shoots, the terminal flower bud, when it has become sterile, the peduncle and the green fruits are cooked into curries, and are much esteemed for such purposes, and sold in the bazaars. The spurious stem abounds in fibre which has been used for textile purposes, and cordage. The coarse or large fruited plantains yield the strongest fibre, the smaller kinds the finest fibre. It also supplies good materials for paper, &c., and a species of tow for stuffing or packing purposes, and the dried petioles or leaf stalks are cut into squares and used to keep snuff, drugs, &c., and a species of tow for stuffing or packing purposes, and the dried petioles or leaf stalks are cut into squares and used to keep snuff, drugs, &c , whilst the dried petioles are the most handy materials within the reach of the gardener or ryot, for tying fences, bundling grass, hundred and one other useful purposes it is put to. The leaves are used as plates by the natives to eat their rice off, and are always sold in the bazaar, for such purposes, realizing from 1 to 3 pies each. They are also used to dress blisters and other raw surfaces, to keep butter cool, and cheese from becoming dry. The dried leaves are also used for packing cigars, fruits, &c.

The fruit is greatly esteemed not only as a luxury, but to afford food, a good plantain is a most delicious fruit. In some districts it is dried and exported; a trade is carried on with the dried fruits from the more Southern districts to Ceylon. It is also exported from Bombay to other parts of the peninsula. The skins of the fruit are used to tan and blacken leather. The plantain tree is considered an emblem of plenty from the number and variety of useful products it yields, and in consequence it is used on all social and festive occasions by the natives to ornament their dwelling. It is also by some considered an emblem of sovereignty. There are many varieties of the plantain. Travancore and Malabar alone produce 70 different varieties.

Cultivation—The plantain produces its fruit within the year; and it is considered a most exhaustive crop, it requires transplantation once in every three years. The plan followed is to put down [illegible] during the month of August in large pits 3 feet deep and 6 feet apart. It requires water and strong manure, the best is fresh horse or cattle dung. As suckers show themselves, they should be removed, leaving only two of different sizes to replace the parent stem, for as soon as the first stem has ripened its fruit it dies, and should be cut out, leaving the larger of the two suckers to take its place, and in like manner the third supplies the place of the second when it comes to its turn to be cut out, after having [illegible] its fruit when they should be removed from the locality altogether to another.

The native ryot values the produce of the plaintain tree at one Rupee each plant a year. The fruit, as a rule, is removed long before it attains the stage of maturity, and is then forced to ripen.

The green fruits are simply cut down and smeared with fresh lime (chunam) and hung up to ripen, or the clusters or combs are separated from the peduncle or bunch, and placed into a large pot packed in straw, on the mouth of this a smaller pot filled with straw is reversed and luted on to the lid of the larger one, with a composition made of cowdung and clay, and then a small hole is made at the bottom, now uppermost, of the little pot, into which a live coal is forced, and the gardener or ryot applying his mouth to the opening blows into it to ignite the straw within, and force the smoke down into the larger pot among the fruits. This is done for 15 or 20 minutes twice a day for three or four days, guided by the stage of maturity the green fruits had attained when packed to ripen when the pot is opened on the third or fourth day, the fruits are found quite ripe and fit for removal. In some localities and much more rarely, the fruits are packed in straw and buried two or three feet under ground to ripen for a few days. The best plan is not to remove the bunch from the tree till a few of the topmost fruits have ripened, when the bunch should be cut down and hung up in the house, in the course of a day or two the whole bunch will have ripened and turned yellow.

Forcing the immature fruit to ripen destroys its flavor. Few fruits are equal to a well ripened plantain of the best variety. Plantains grown in cold climates lose their sweetness and flavor and eat insipid and mealy. This is the case with fruits grown in Hot Houses in England.

I also find this to be the case generally in Hill stations 3,000 to 4,000 feet above sea level during the cold season. The fact is the low temperature does not admit of the conversion of the starch of the fruit into sugar, and therefore it eats insipid and mealy..

The plantain is universally considered a most wholesome fruit, and is never absent at meals in most well-to-do families.

Plantain trees are liable to be blown down by strong gusts of wind, the weight of the fruit helps to bring it down,—lofty trees more particularly suffer in this way. They should be planted in sheltered localities, and even then, as the fruit forms, most of them have to be supported by stakes to prevent their breaking down.

A good bunch of plantatains, if of the larger kind, will contain over a hundred fruits, whilst the smaller kind over a thousand fruits, and weigh from 50 to 60 pounds each bunch

With this paper I submit nine drawings of different kinds of fruit, and four of plants; among the latter is a drawing of a plant called "Bombay" plaintain. I have not seen this kind before; the leaves are striped white and the fruit in like manner is said to be striped white and green. I have not seen the fruit myself. I regret this paper is not so complete as it might have been from the want of leisure, and unfortunately I have mislaid the list of local names of other districts than those mentioned in this paper. For the drawings themselves I am indebted to C. Abboye, a *quondam* pupil of the Madras School of Arts.

MADRAS AGRI-HORTICULTURAL SOCIETY.

THE Madras Agri-Horticultural Society have published the programme of their Annual Exhibition to be held early in February 1879.

The following are the "classes" for which prizes are offered:

Class I. Flowers in pots exclusive of Annuals.
12 prizes aggregating ... ... Rs. 86.
Class II. Annuals in pots.
10 prizes aggregating ... ... Rs. 53.
Class III. Cut flowers.
8 prizes aggregating Rs. 27, and a silver bouquet-holder.
Class IV. Orchids, ferns &c.
11 prizes aggregating ... ... Rs. 128.
Class V. Rare plants.
2 prizes of ... ... Rs. 15 each.
Class VI. Vegetables grown in Madras.
18 prizes aggregating ... ... Rs. 46.
Class VII. ('open only to Market gardeners') Vegetables.
24 prizes aggregating ... ... Rs. 98.
Class VIII. ('open to all') Fruits.
20 prizes aggregating ... ... Rs. 109.

In addition to the above there is an "Extra Prize List." With reference to which the Hon'ble Secy. writes as follows:

The Government having placed at the disposal of the Society a sum of Rs. 500 they have much pleasure in offering the following prizes:—

The Prizes from I to IX inclusive will be open to the produce of the Madras Presidency, Hyderabad, Mysore, Coorg, Travancore, and Cochin.

I.—Best sample of coffee, not less than 20lbs., of which 4lbs. in parchment, and 16lbs. cleaned in three sizes, with one 1lb., of pea berry, a gold medal.

II.—Best sample of tea, not less than 30lbs., a gold medal.

III.—Second best sample of tea, not less than 20lbs., a silver medal.

IV.—Best sample of indigo not less than 5lbs., a silver medal.

V.—Best sample of cured tobacco, not less than 10lbs., a silver medal and ... ... Rs. 20

VI.—Best cured sample of country tobacco, not less than 10lbs. ... ... Rs. 20

N. B.—All articles sent to compete for any of the above prizes must be accompanied by a written declaration from the exhibitor, stating how many acres or cawnies of land he has had under cultivation, and that the sample exhibited is *bonâ fide* the produce of that land. Tea must be sent not later than the 15th December, and the other articles must be delivered at the Society's Garden two days before the show.

	Rs.
VII.—Best sample of silk, not less than 1lb.	25
VIII.—Best sample of tassa silk, not less than 1lb. ...	25
IX.—The best general collection of produce usually exported from Madras. Each article to have its name and use separately given	50
X.—Best general collection of forest products, such as gums, lac-resins, wax, dyes, &c.	20
XI.—Best talking bird	5
XII.—Best singing bird	5
XIII.—Best furnished aquarium	10
XIV.—Best Gold and Silver fish	10
XV.—Prize offered by H. S. Thomas Esq., F. L. S., &c. Best Tassa silkworm, fishing gut, not less than twenty lengths	20

We hope this attractive programme will produce a competition really worthy of Southern India.

FORESTRY.

THE Government of Bengal has already been doing well with its forests. Dr. Schlich in his report for 1877-78 states that the surplus of receipts over charges was Rs. 1,71,251, as against Rs. 10,712 in the previous year, and yet scarcely 40 square miles have been added during the twelve months. The present area demarcated is 3,430 square miles, while in 1872 only 106 miles had been dealt with. It is further proposed to take over an extensive tract in the Chittagong Hills, and to extend operations both in Darjeeling and Julpigori. At the end of the current year about 4,406 square miles will be under the direct care of Government, of which 823 miles will be in the Lower Himalayas, the Terai and Dooars, and the rest in Chittagong, the Sunderbunds, Chota Nagpore and Shahabad. This increase in area will involve some additions to the staff of conservators, but with results such as those recorded, there should be no difficulty in obtaining sanction for this. The classes of timber now reserved are chiefly 1,090 miles of sâl forest, with savannah, mixed forest and lower hill forest containing sâl, and 1,581 miles of sundry forest The people are at last coming to recognise that the forest rules must be respected, and they are settling down to the new order of things very quietly There were only 112 prosecutions in the year, while in 1876-77 the number was 233. The Conservator reports that the decrease is owing to forest protection having become more effective, and he considers that the few attempts made to violate the rules, prove that forest conservancy does not press too hardly upon the people; the great majority of the cases occur in the Sunderbunds, where, however, conviction is difficult owing to the immense area under forest and the existence of private grants in the neighbourhood of the Government reserves. This proof of the easy incidence of the forest laws upon the peasantry, who have hitherto used the trees with shameful extravagance and blind improvidence, is the happiest feature of the report, as there were many doubts of the effect of reservation upon the minds of the ignorant ryots. Many experiments are being carried on with economic plants and trees, and one fact has been established . neither the eucalyptus nor the carob tree is at all likely to thrive in the Delta of the Ganges. India-rubber plants give signs of future robust strength. The great enemy of the forester is fire during the dry season, and precautions were taken to guard 122,728 acres, but failure was reported in the case of more than 43,000 acres. More money is henceforth to be spent in this direction, as the timber is too valuable to be thus destroyed. The reserve forests were largely drawn upon for timber for the Northern Bengal State Railway, and the felling of sâl trees was in perhaps a few instances too freely indulged in. However, rest is to be given to certain tracts, and the cutting can carefully be regulated. The surplus revenue in the year under notice is certainly very great, but the Conservator is sanguine enough to prophesy that "in future years it will be still greater, and that the Government forest estates in Bengal may now be said to have become a source of permanent and increasing returns to the State."—*Pioneer.*

IT is stated that the Lieutenant-Governor of Bengal has invited the attention of all Magistrates and District Road Committees to the advantages to be derived from planting mango, jack, or other indigenous fruit bearing trees along the lines of road in every district. His Honor is of opinion that the income that would be eventually derived from such trees would well repay the cost of protecting and tending them now, and in times of scarcity the fruit would form a material addition to the resources of the district. This is a thoroughly practical suggestion, and we hope good may come of it.

LIEUT-COLONEL R. H. BEDDOME, Conservator of Forests, in writing to Government in reference to G. O., No. 1090 of the 18th July last, states that he procured small supplies of the seed of the *Pithecolobium saman* in 1869 and 1870 from trees which had been introduced into Ceylon some years before, as he had heard that it was likely to be a most valuable fuel tree of very rapid growth. All this seed was sown in the Cuddapah fuel plantations; it germinated well, but all the trees have since died off, except two in Kodur and nine in the Pullampet plantations; of the former one is now 18 feet high and 9 inches in girth—the latter are not healthy and do not show good growth, the soil in those plantations is very poor, and the trees have taken chance with others, and not received garden treatment. Again, in 1871, he received a very small packet of the seeds and these were all sown in the Ammerdy experimental plantation, in North Arcot, near the foot of the hills where the soil is good alluvial. Twelve seeds germinated, nine of which were sent to Palmanair and planted in red gravelly soil, but are reported not to have grown at all well; the remaining three, which were kept at Ammerdy, have grown more rapidly than any other species of trees there, not excepting casuarina; they are all about 4 feet in girth at 3 feet from the ground and 40 feet high, with wide spreading branches; one of them branches into three limbs near the base, each limb being over a foot in diameter; he had one of these limbs cut towards the end of last year, and it contained upwards of a bandy-load of timber. Mr. Shefield the forest officer in charge of the plantation, reported that the wood was soft, and when used as fuel gave out a very unpleasant odour of ammonia. These three trees have received what may be called garden cultivation. He mentions that there is a splendid example of the tree growing in the garden of the Judge's house at Tinnevelly, and there can be no doubt that the tree will answer admirably in good soil in the plains, particularly near the sea, if it receives garden cultivation, and it will be of value for avenue, tope and park purposes, and for the fodder yielded by its legumes, but it is not likely to be of value in our firewood plantations and reserves, where we cannot afford to attempt any thing like garden cultivation, and it is not likely to succeed above ghauts, least at any elevation.

KONIGSBERG papers report the appearance last spring in that neighbourhood of a bark scarab, which confined its attacks exclusively to ash trees. The enemy appeared upon the scene in countless multitudes, and all milder treatment having proved unsuccessful, heroic measures were at last adopted to prevent the spread of the mischief The whole of the magnificent trees between Bledau and Beckhafen were cut down, and the trunks built up into a sort of funeral pile, which was then set fire to, and allowed to burn till the beetles were destroyed, after which the charred timber was disposed of for what it would fetch. Such extremely drastic proceedings appear to have been hardly necessary, for other ash trees in the neighbourhood similarly attacked were effectually protected by smearing them from top to bottom with tar, and are now standing as strong and sound as ever.

SINCE Sir Arthur Phayre's appointment as Governor of Mauritius he has taken a deep interest in the question of putting the island under a thorough system of forest conservancy. His previous experience on all matters appertaining to forestry, acquired during many years' residence in British Burmah, has given him unusual qualifications for dealing with this question, with the result that application has been made to the Indian Forest Department for an experienced forest officer, who, after a year's residence in Mauritius, will furnish a detailed report on the present state and future prospects of the forests; and "at the same time initiate a system of forest conservancy which while it shall be complete, and of general and material utility, shall also, it is hoped, prove remunerative."

CONSUL Drummond Hay in his report upon Mogadore, the principal port of Morocco, mentions the existence of forests of the argan tree, which afford nourishment both for the natives and their flocks in the times of drought and scarcity. This remarkable tree grows only in certain provinces of the country, and is utilised in the following ways:—In the first place, the peasants extract the oil from the nut, which is useful both for burning and cooking purposes. When the nuts ripen and fall off the trees they are collected by the natives, who are aided in the harvest by their goats. These animals swallow the fruit for the rind, but, being unable to digest the nut they throw it up again, and it is then added by their owners to the store for making the oil. For their private consumption the peasants rarely make a large quantity of oil at a time, but crack open a few handfuls of nuts with a stone, and after toasting the kernels in an earthenware dish, grind them to flour. The oil is extracted by adding water in small quantities to the flour, which is stirred in a bowl. As the oil is being formed by this process, the flour hardens into a cake, which is finally squeezed, leaving the oil perfectly clear and fit for use. This kind of oil-cake then serves as an excellent food for cattle, as does also the dry rind of the nut, which is generally given to them with the cake, forming together their principal and most nutritious food during the year. It is invaluable to the natives in time of drought, for the argan tree is very hardy, and a dry year has little if any effect upon it. Even the empty husk of the nut, when broken, is not thrown away by the peasants, but used as fuel. The best charcoal is made from the argan tree, and the dry timber is excellent firewood. The goats feed also upon the leaves of the tree, and when browsing in the argan forest may be seen climbing amongst the trees plucking and nibbling the nuts and leaves.

THE POONA FOREST SCHOOL.

ALL the world, or perhaps we ought to say all the forest world, knows that for the last twelve years the superior staff of the Forest Department has been recruited chiefly by men trained in the schools and forests of France or Germany, while the more numerous subordinate posts have been given to men not especially trained. Now the latter, to be thoroughly useful, ought to have some elementary knowledge of forestry; at least so some people think, amongst others His Excellency the Governor in Council, who has decided on establishing a training school for native forests in connection with the Poona Civil Engineering College. The details of the measure were left to Mr. Shuttleworth, Conservator of Forests, Northern Division, who, in consultation with certain members of the Educational Department, has drawn up a programme of studies. The list of subjects comprises meteorology, surveying, chemistry, botany, including anatomy and physiology, forestry, and several other sciences "too numerous," as the announcement says, "to detail." The course is to extend over two years, and there are to be geological and forest excursions to vary the monotony of college life.

When proposing the establishment of a training school at Poona, the Governor sketched out a more ambitious and, to our mind, much more suitable plan; but even his scheme was too elaborate for the training of men who are to commence their official career on fifteen rupees a month, as some of the students are expected to do. It is not apparent from the extract of Mr Shuttleworth's report, given in the Government Resolution now before us, what standard of proficiency will be demanded of applicants, but, as the course is to last two years, we may assume that a good knowledge of forestry and a fair knowledge of the cognate subjects of Mr. Shuttleworth's list will be demanded, although perhaps *quantitative* analysis which is apparently one of the obligatory subjects, may not be insisted on. The examination promises to be a stiff one; it will be in fact, about equal to the examination which men appointed in England have to pass, and we must confess to being somewhat surprised at the same standards being demanded from men of both classes. In framing the rules, Mr. Shuttleworth has evidently been guided by those which are laid down for the appointment of home-trained candidates for the superior staff. Herein he is, we think, mistaken, for it is quite unnecessary that men for whom this course of training is intended, should know anything that is not purely practical. Vegetable anatomy and physiology, although high sounding and pretty on paper, are fortunately subjects of no practical value whatever in forestry. Chemistry is another subject which may safely be left to the professional experimentalist. Put to the practical test the number eleven of Mr. Shuttleworth's obligatory subjects may be reduced to four—namely, forestry, mathematics, surveying and political economy, and law. It does not appear clearly from Mr. Shuttleworth's report what is meant by "forestry," but we gather from clause 8 of the rules that instruction under this head is to consist in teaching the students to sow seed, and to plant and cut down trees. As this is rather an important subject, we venture to suggest that a little sylviculture or the natural and artificial regeneration and subsequent treatment of forests should be taught at all events, theoretically, if ocular demonstration is not feasible. Then there is forest organization, a most important, in fact the most important, branch of forestry, which ought not to be neglected. Of the allied subjects, surveying is by far the most important, as a knowledge of it is necessary in organizing forests, and none of our forests have been organized. Organization consists mainly in determining the annual sustained yield (*i.e.*, a yield which can be kept up for ever) and is the end and aim of all forestry; in theory, it has been reduced to an exact science. The lectures on sylviculture would teach the students as much botany as is necessary. If they are able to recognize the principal forest trees and know their properties, they will know quite enough for all practical purposes. The same subject would also treat of soils and petrography in a practical way, without entering into the matter scientifically. The political economy of forests and forest law would constitute the fourth subject; it is well for foresters to know in what way the forest trade differs from other trades, and why it is necessary for Government to take charge of forests. Some may object to our attaching so little importance to thorough knowledge of botany. Our answer to them is that the immediate business of a forester is not the determination of unknown plants, but the utilization and regeneration of those that are known to be useful, the removal of those that are noxious, and organization. Now, the trees known to be useful may be counted on one's fingers, and they are so well known that their properties and uses are known to almost every inhabitant of their habitat, who is therefore a capital botanist from a forest standpoint, although he may not be able to see any difference between a stamen and a pistil. It has always been a mystery to us why people, in this country, who ought to know better, generally regard botany as about the only study worthy of the serious attention of foresters; views of this kind could only be entertained by those who will not take the trouble to find out what the duties of a forester, the requirements of Indian forests, or, for the matter of that, of any forests really are. That a knowledge of scientific botany is useful, no one will deny; but, as it is not absolutely necessary for the performance of a forester's duties, it is as well to protest against its being placed above purely forest subjects, a knowledge of which is necessary.

Six appointments on from fifty to twenty rupees are to be given to the first six men on the list at the final examination at the college. Others may also get appointments, but no further promises are made. The college opens this month (November.) Previous to its opening there will be an entrance examination, when two scholarships of Rs. 8 a month and two of Rs. 7 will be awarded. Considering the object in view—namely, that of educating men for the subordinate establishment only of the Forest Department, the course appears to be very long; probably one year's residence at the college will be found to suffice for all practical purposes.—*Bombay Gazette.*

THE WANT OF FORESTS.

[*The following able Memorandum on "Forests as affecting the welfare of India,' came from the pen of the Lieut.-Colonel James Vertue, R.E, of the Madras Public Works Department, and is well deserving the attention of the Famine Commission.*]

DIVISION OF THE SUBJECT.

This I would propose to divide into five main heads.

1st—Effects of fosests.

2nd—Results of destruction of forests.

3rd—The present state of affairs.

4th—The remedy.

5th—Difficulties in the way of adoption of remedial measures.

EFFECTS OF FORESTS.

Under the head, six points stand out in strong relief.

Mitigation of floods.—The terrible dissasters caused by floods, are so well and widely known as to call for little remark; but I think it will be found on examination that their most destructive effects have occoured in parts of the country most bare of wood. The evil effects of floods increase with the comparative rapidity of rise of the rivers which cause them; and that the flow of the surface water is checked by belts of forests and diminished by absorption in passing through them, there cannot be a shadow of doubt.

Increase of Volume of Springs.—This is just as plain and palpable as the other. Every tree by its numerous rootlets serves as a duct by which water percolates the soil. What then must be the effect of a forest containing an enormous number of trees! And it must be remembered that it is on wells and the springs which feed them, that perhaps 4-5ths of the population are dependent for water.

Reduction of Temperature.—This also is indubitable. The temperature of France has increased since historic times, and for this no cause can be assigned but the destruction of the forests; and the same holds good in both England and Scotland, and has formed matter of observation within a comparatively very recent time. The improved land drainage will in the latter case no doubt, account in a great measure for this, but that the other cause has also operated, there can be little doubt. Any one who is acquainted with the result of the reduction of the mean annual temperature by even 1 degree will not be disposed to treat this subject lightly. The effect is produced, not only by the shielding from the sun's rays of a greater portion of the surface, but also by the moisture produced in the atmosphere by exhalations from the leaves, which exhalations increase the copiousness of dew and induce precipitation.

Aid to Precipitation.—It is a common remark that trees increase rainfall in virtue of their attraction. This is a popular error, and yet contains an element of truth. Trees no more attract rain, than do lightning conductors, lightning; but, owing to the cool, moist strata over forest areas, it is quite conceivable that water may be discharged from masses of cloud passing over, which a bare burning surface would retain in vapour. Air is known to be an extremely bad conductor of heat, and leaves reflect but little, whereas the earth becomes intensely heated, and if the soil be light in colour, a great deal of the heat is reflected, heating the superincumbent air by connection. In accordance with this, it is well known that rain often follows the course of a river, and no doubt a belt of forest would produce a similar effect.

Dissipation of Solar Heat.—This fact, by no means so well known as the others, is due to the principle now known as the dissipation of energy and depends on the obvious fact that power must be expended where work is performed. Now a considerable amount of solar heat is expended in the decomposition of carbonic acid, required to furnish carbon to the structure of leaves, plant and trees; and from this ensues a reduction of solar heat.

Increase of Fertility of the Soil.—This is effected in two ways; first by the formation of humus caused by the decomposition of fallen leaves, &c., and also by checking the denudation of the surface soil, which in some localities proceeds at a fearful rate; and where the surface soil is originally shallow with a rocky substratum renders cultivation almost hopeless, the rain that falls being very quickly evaporated. Further, the removal by water of the surface soil, chokes the beds of our rivers, and is productive of other evils.

RESULTS OF DESTRUCTION OF FORESTS.

Summary.—Obviously these are in every case the negatives of the preceding.

They raise the temperature.

They diminish the rainfall.

They increase the devastating effects of floods.

They diminish the fertility of the soil. But it must be remembered that of the above four results any three more or less act on the 4th; thus each of the first three has a separate action on the last, causing the resulting evil to increase more in geometric than in arithmetic ratio.

Illustrations.—I shall mention a few instances of the effects produced by disforesting. *1st.*—At one time, the island of Santa Cruz was well wooded, and was a perfect garden: for some reason unknown, over one-half the wood was cut down, the consequence being that this portion is almost a desert, the other remaning as before.

2nd.—Within 30 years of the establishment of Umballah as a Cantonment, the water in the wells has sunk from 24 to 50 feet.

3rd.—In the N.-W. and in the Punjab, General Cunningham found, by actual measurement, that the water in the wells is 6·10 feet lower now than in the time of Akbar.

4th.—A few remarks on evaporation may here not be out of place. From experiments carried on in England during eight years, it is found that the mean annual evaporation is 57 per cent. of the rainfall, while during the four hottest months of the year, it is no less than 95 per cent.

From rough calculations, which I myself made regarding a portion of the South Arcot district, the mean annual evaporation is 70 per cent.; this probably is considerably underestimated.

"The evidence that the great floods which have from time to time during the last half century been so destructive in Switzerland and in many districts of France and Italy, have been mainly caused by the felling of the forests on the high ground, appears to be overwhelming. In the department of the Loire, especially, it was universally remarked, that the wooded grounds suffered no change, while in the denuded districts, the whole soil of cleared and cultivated fields was swept away, and the rocks laid bare. The same was seen in the Upper Rhine in 1868. The clearings in the province of the Ardeche have produced the most melancholy results within the last thirty years, one-third of its area having become barren; and new torrents had, in 1842, destroyed 70,000 acres of good land, an evil which has been going on ever since that time. The denudation of the crests of the Vosges has done infinite harm in Alsace. Many places in Provence rich and inhabited half a century ago, have become deserts. Thousands of torrents have been formed within the last dozen years in the southern flank of the Piedmontese Alps; and in Dauphin grassy slopes have been converted into stony chasms by the cutting of the woods above. In the department of the Lower Alps, between 1842 and 1852, 61,000 acres went out of cultivation from this cause. In Italy the demand for Italian iron during the wars of Napoleon I. (the trade with England being cut off,) necessitated vast cuttings of wood for fuel, and the effects are felt to this day, especially in the valley of the Po. In fact there is scarcely a country on the continent of Europe in which the reckless destruction of forest has not been admitted, (both in popular belief, and by the verdict of science) to have been the cause of misery, of the amount of which the majority even of well-informed persons in England have little conception. The evil has been made the subject of minute investigation by innumerable scientific men, and the leading scientific bodies in France, Italy, Germany, and even in Russia, and has engaged the attention of Government in several of these countries. Much has been done, and is now proceeding, for the repair of the mischief, especially in France under legislative authority by the operations of Reboisement, or the judicious planting of certain places near the ravines which have been formed. The results of this process are necessarily gradual, but enough of benefit has already accrued, to confirm the accepted theory of the evil. The principle on which the efficiency of forests depends must be evident from the quotation we have given above. We may form some conception of the extent to which the impetus of violent rain is diminished by sub-division and evaporation, when it falls upon wooded, instead of open ground, by the fact that it has been calculated that the leaves of a moderately large elm present a surface equal to 200,000 square feet. The chief influence of forests, however, evidently depends on the vast spongy mass formed by the innumerable root-fibres; and in situations where the winters are severe, on the much smaller depth to which the earth is frozen in wood-land than in the open, so that melting snow and spring rains flow in full volume over the latter, while they are detained and absorbed in the former. Anybody may test the effects of wood on drainage by observeing the ditches on either side of a road, where the ground on one side is planted and on the other cultivated. *Cœteris paribus*, the water after heavy rain will be seen to linger for some time on the one side, and to disappear rapidly in a sort of flood on the other."

THE PRESENT STATE OF AFFAIRS.

There are several well-known facts, which I cannot support by statistics, and I therefore merely enumerate them. Is is not the case that the average produce per acre is decreasing? Is it not the case that floods are becoming more common, and more destructive? It is not the case that the quantity of manure used for fuel is annually increasing in a higher ratio than the population, depriving the soil of what should be applied to it, and tending to decrease its production?

What is Government doing?—I think the reply must be, very little. They are to a certain extent conserving forests proper, *i.e.*, reserving portions, and protecting them from fires and other destructive agency, and this is very well as far as it goes; but it must be remembered this is, as a rule, going on where there is timber and to spare; it is precisely in the parts of the country where there is a dense population, and a lamentable scarcity of timber, that so little is being done. I do not at all under-rate the difficulties to be encountered, as they are simply enormous; but they have, to a great extent, been made so by the way the matter has been neglected, or ignored, and the march of time will only increase the difficulties very greatly.

Increase of Population.—Estimating the population of India at 200 millions, and the yearly increase at 1½ per cent., the annual increase is 3 millions, and the greater portion of this, certainly two thirds, takes place in the denuded portion of the country, but for this increase, fuel must be provided. There cannot be a doubt in the mind of any one who knows the country in question that the timber (forest it cannot be called) is diminishing. Every year hundreds of trees are blown down; many more are cut down for various purposes, and very few are planted. The operations of the Forest Department are limited by funds, and there are few outside that department who take any interest in the matter. It must not also be forgotten that a very large quantity of fuel is consumed for railway purposes. It may be said that coal will sooner or later entirely take the place of wood. English coal certainly will not, as owing to the largely increased export, the increase of population at home, and the additional cost of raising it from increasing depths, the price of coal must rise. In fine, then, I consider that, in the face of a yearly increasing quantity of fuel required, timber is becoming scarcer, the country barren, and the soil less fertile, while the temperature is rising, the springs becoming less copious, and floods more destructive.

DIFFICULTIES IN THE WAY OF CHANGE.

These are mainly two in number.

1st.—Disbelief in facts.

2nd.—Want of interest in the subject may be added.

Disbelief in Facts.—One class will accept nothing without statistics to prove the disappearance of timber, and these are not forthcoming. Another will say how can cutting down a few trees make any difference. Such men will doubt that the dropping of water will wear away hard rock.

Another will say 'I have travelled over the country in many directions, and except in a district such as Bellary, the country seems well wooded.' To which I would reply that a Railway traveller is apt to form very false impressions of a matter such as this.

Want of interest in the matter.—Public officers, more particularly those in the Revenue Department, have so many subjects demanding their attention that they may be well excused for refraining to do anything that will add to the number; but I feel very sure that in all but what may be called Forest Districts, officers must subscribe in the main to what I have here laid down.

REMEDY.

Planting by Villagers recommended.—There is but one remedy, so far as It can see, and that is to make planting compulsory by villagers, making, if necessary, payments by results. Those who know the many demands on Government funds, will estimate the likelihood of anything of real service being done by Government as very small indeed. Of course there will be numbers who will exclaim against such a scheme as arbitrary and oppressive; taxation in any shape much more or less partake of these appellatives, but if any one can suggest another plan, which will be equally efficacious, let us have it by all means.

System to be adopted.—As regards the system to be adopted, this would be best matured by a committee composed partly of forest officers,

Simple means of forming village plantations.—One very obvious means occurs to me to utilize the numberless tanks scattered over the country. Many of these are extremely shallow, very costly to maintain, and the crop dependent on them extremely precarious. I would advocate planting up the beds, an rendering the water which now fills them available for the better supply of others to be improved. As, however abandonment of a tank is to the Board of Revenue like having a tooth drawn, there is another plan which might be very easily carried out. Deepen a portion of a tank near the end and with the earth taken from the rectangular pit thus formed, raise the ground at the end a little above mean water level. On this ground thus raised form a plantation. There would be no appreciable loss of water to the cultivation by this means, as the deepened portion would hold more water, and by its greater depth would retard evaporation; the plants themselves would not require a great deal of water, and any surplus would filter into the tank again.

Views here advanced either right or wrong.—I would in conclusion remark that the views I have here put forward are either wrong or right; I wish I could believe them to be the former, but I cannot; and if I may seem to exaggerate, I would say that the apparent total absence from the public mind of any idea of the true state of affairs, suggests the necessity of a strong stimulant being required to rouse it. If my views are correct, I think it will be conceded that the prospect is alarming, and it should not be forgotten that the evil, and perhaps also the difficulty and cost of combating it, increases year by year in geometric ratio: further that is the very acme of selfishness to put forward the opinion that ages may pass before there is a vital change for the worse. The apparently extreme slowness of the deterioration constitutes the greatest obstacle to the application of remedial measures, as it leads to disbelief in the facts advanced.

CONCLUSION.

Additional strength lately given to the views here advanced.—This memo. has been for some time ready, but believing myself to stand almost alone in my opinions, I felt a natural reluctance to put them forward; lately however, they have received the strongest possible confirmation in the Report of the Superintendent of Government Farms on the agriculture of the Coimbatore district. The views put forward by Mr. Robertson are precisely my own, save that Mr. Robertson estimates the destruction of the timber and the deterioration of the soil at a much higher rate than I have ventured to do, and I need scarcely say his opinions are worthy of all consideration.

Mr. R. Elliot's views.—In a lecture lately delivered before the Society of Arts in London, Mr. R. Elliot, the well known successful coffee planter, advocates precisely the remedy I have proposed, *viz*, planting by villagers. As a shrewd, observant man, with long experience of the country, I consider Mr. Elliot's views deserving much attention.

Proof of non-appreciation of the situation.—Had I ever entertained a doubt of this, it would have been removed by a G. O. No. 15 of 7th May, by the Chief Engineer for Irrigation, who remarks: "Plantations should be left to the department whose more immediate duty it is to prevent the country being denuded of trees, and to supply the wants of the country generally." In this opinion Government concurred, In the first place I would remark, what can the Forest Department do with the paltry funds at their command, and what likelihood is there of these being so largely increased as to avail much? In the 2nd place, it seems to be a *sine qua non* that Forest Department work is to be, if not immediately, yet very speedily remunerative, and already it is proposed to abandon many plantations which do not pay. The Forest Department does admirable work, but it will not avail even to stay the ruin which is going on, much less improve matters. What is required is an effort streching over, and throughout the Presidency. The Chief Engineer for Irrigation may be an authority in irrigation matters, but in this he is just as ignorant as his neighbours.

Extensive chemical analysis recommended.—In conclusion, I would beg to recommend what years ago, I advised, *viz.*, that there should be a chemical analysis made of all food products of the straw as well as the grain, that all soils should be chemically analysed, and further that the same should be extended to common jungle shrubs and bushes, many of which in practice are found to supply, when ploughed into the soil, constituents in which the latter is deficient. There are thousands upon thousands of acres perfectly barren saline soil which might by this means be made productive.

Slovenly and imperfect cultivation of dry lands deprecated.—One more point is, I think, deserving of special attention, *viz.*, encouraging ryots holding dry land, to reduce the area of their cultivation, and to cultivate better that reduced quantity. In the best seasons the yield is perhaps only half that produced by better manuring and cultivation, while very often there is a total failure, or nearly so. The loss of labour and seed involved in the present system, is enormous. When one-half the present area of dry cultivation better cultivated, and the other half utilized for plantations and pasture, there would be an immense improvement in the ryot's condition.

Well cultivation deserving of all encouragement.—Last of all, too much encouragment cannot be given to well cultivation. Water thus employed, does the maximum of duty, and owing to the relatively small area of land required, very high manuring is possible and is employed, and enormous labor saved in ploughing and other items which in a great measure compensates for the labor required in raising the water.

PROPOSED FOREST GARDENS.

THE Government of India has issued the following Resolution, dated Simla, the 5th November 1878:—

The Governor-General in Council has lately had under consideration the measures that may now be taken in order to organize, on a more systematic plan than hitherto, the attempts made by forest officers to introduce foreign trees into India, and to study the mode and rate of growth of indigenous trees.

2. It appears to His Excellency in Council to be an essential condition of success, in the case of all experiments in arboriculture, that they should be made under permanent and competent supervision. Past experience has shown that the wholesale distribution of seeds and plants of exotic trees does not, as a rule, lead to any satisfactory results. On the other hand, the success attained in introducing foreign trees, where experiments have been properly supervised, has been considerable. The Governor-General in Council is therefore of opinion that the attempt to introduce valuable timber and fruit trees from other countries, if conducted in future on a systematic plan, and with due care and discrimination, is likely to produce results of great value to forest management and to the country generally, and ought to be persevered in.

3. The chief point to be attended to is, to concentrate operations in each province upon one or a few selected localities where competent supervision is available during the greater part of the year. In such places small plantations or forest gardens should be established, whose object will not only be the experimental cultivation of exotic trees, but also to afford greater opportunities to Forest officers than exist at present, for studying the mode of growth and the requirements of indigenous trees. A selection of important and useful indigenous trees, which are likely to thrive in the district, should be raised on such a scale as the demand may justify, with the view of distributing the plants raised for forest plantations, avenues, topes, or other purposes. These forest gardens will, in fact, be large nurseries, groups of trees being allowed to grow up; or, in the case of exotics, small experimental plantations being added. No definite rule can be laid down regarding the area required for such forest gardens in different provinces and districts, and this must obviously be regulated by circumstances.

4. Experimental plantations already exist in most provinces, which are used or may be used in the manner here indicated. Such, for instance, are the Changa Manga plantation in the Punjab, the Telenkheri garden near Nagpur, some of the fuel plantations near Bangalore, the Bamunpokri, Rungbul, and Sitapahar plantations in Bengal, the Kulsi and Shillong plantations in Assam, the Magayee plantation in Burmah, and others. In connection with the Forest School, now established in the North-Western Provinces, a forest garden should be formed at Dehra Doon, and another in the hills of Jaunsar.

5. The Governor-General in Council does not wish to encourage any undue outlay on these experimental plantations, and it is not desired that they should be increased without necessity. In selecting sites for any new plantations that may be decided upon, in should be borne in mind that competent supervision must be available during the greater part, if not during the whole year, and that the place must be central and easily accessible. Matters should be so arranged that the experience gained at each forest garden may be utilized for as large an extent of country as possible.

6. If the plan here sketched is correctly understood and carefully followed out, forest gardens may eventually become of great importance for the distribution of seeds and plants, not to Forest officers only, but also to District and Canal officers, to public gardens, and tantamount authorities.

7. As regards the supply of seeds of exotic trees, the Government of India will, whenever such may appear desirable, continue to procure seeds and plants from Europe, America, Australia, and other distant countries; but Conservators of Forests should be encouraged to obtain, under the orders of local Governments, seeds and plants, either direct, or through the Superintendents of the Botanical Gardens at Calcutta and Saharanpur. If necessary, any outlay incurred on the supply of seeds and plants by these gardens may be refunded to them by the Conservators. The transmission of seeds through the Government of India not unfrequently causes unavoidable delay, and it is probable that seeds, and in some cases also plants, may be obtained direct by Conservators at less cost and with greater expedition. The Governments of Bengal and the North-Western Provinces and Oudh will be requested to authorize the Superintendents of the Gardens named to give every assistance to Conservators of Forests in this respect. On the other hand, Conservators should endeavour to assist these Botanical Gardens in obtaining seeds and plants whenever an opportunity offers for doing so.

8. A careful and complete record of all experiments made in these forest gardens should be maintained, and abstracts of it should be recorded in the Annual Progress Report of the Forest Department in each province.

SANDALWOOD IN MYSORE.

THE following letter is from the Secretary to Government of India, Department of Agriculture and Commerce, and has reference to the orders lately issued by the Mysore Government relative to the enumeration of sandal trees in the provincial forests: "I am directed to acknowledge the receipt of your Secretary's letter No. 1605—241 R.-F., dated the 20th ultimo and in reply to state that the Government of India approves of the order issued by you to stop the enumeration of growing sandalwood trees in Mysore. The Conservator proposes that the offices of the Forest Department should, after inspection, submit detailed reports on the sandalwood growing in the different taluks. This might be feasible if sufficient time were left to accomplish the work, but it is obvious that no useful result can be attained in this respect within the few remaining years of British rule and therefore the proposal must not be entertained. Under existing circumstances the Governor General in Council desires it to be distinctly understood that nothing must be permitted to divert the attention of the Conservator and his officers from the necessary work that remains to be accomplished, as sketched in paragraph 9 of the letter from the Government of India in the Foreign Department, No. 1642 P, dated the 8th ultimo, to your address. Every effort should, however, be made to attain success in the sandalwood plantations, and I am to point out, with reference to paragraph 11 of the Conservator's letter No. 947—169 F., dated the 22nd

July last, that it has no where been laid down by the Government of India that the cheap system of cultivation hitherto tried is the only one which should be attempted. On the contrary, every endeavour should be made to stock sandalwood plantations by any method that may in the opinion of the Conservator appear likely to succeed. In a letter from this Department No. 449, F. of the 24th April last, extraordinary cuttings of sandalwood were sanctioned in accordance with your recommendations, and I am directed to state that if the instructions contained in paragraphs 5 to 8 of that letter are carefully attended to, a vast amount of work remains to be accomplished by the Forest Department in Mysore."

MINERALOGY.

THE WYNAAD GOLD FIELDS.

THE facts brought to light in connection with the Wynaad gold fields are calculated to put an entirely new complexion on the struggling gold industry of the Wynaad region, and may not improbably result in an Indian yield of the precious metal which will materially enrich the country. India has to thank Sir Andrew Clarke for the discovery of the hidden treasures. His experience of Australian gold fields led him to believe that the quartz regions of the Nilgherries and the Wynaad, which he visited last February, were rich in gold, in spite of the comparative failure that had attended previous efforts in gold mining, and he persuaded the Viceroy to let him send to Australia for an expert whom he could trust. Mr. Smythe, in reference to gold hunting, is an expert of experts. He was for some years Secretary to the Board of Mines in Australia and the chief adviser of the Government in all mining operations, but he had a disagreement with his Australian chiefs, and put his services at Sir Andrew Clarke's disposal and came to this country. He has now been engaged for some months in examining the auriferous regions above referred to, and he has reported the most brilliant discoveries. Hitherto the results of quartz crushing in the Wynaad have been counted in penny weights to the ton. Mr. Smythe reports "56 ounces to the ton," "204 ounces to the ton!" "gold *in situ*," "lumps of gold in the rock" as the issue of various experiments and researches. He declares himself to have got on the vein of gold, and that there is no doubt as regards the future of the Wynaad. In an area of 25 miles by 13 he has found ninety outcrops of ore with a reef thickness of two to four feet. Some stone when broken shows fine and coarse gold with jagged pieces as large as peas. All is not gold that glitters, it is true, and in this case, though the glitering is undoubtedly that of gold, it is possible, that the richness of the new fields will disappoint early expectations; but at all events there is ground for great hopefulness.

Mr. Brough Smythe, we may note, has suggested a new theory as to the formation of quartz reefs and the run of gold in them. Instead of the generally accepted idea that the veins of quartz are to be attributed to fissures formed in the original rocky crust of the earth, which were subsequently filled up by silicious deposit, Mr. Smythe is of opinion that the quartz veins are in constant course of concretion from the adjoining rocks, the silicious and metallic particles being extracted and collected by molecular or other action, and he is of opinion that the payable gold in the reefs will be found in more or less defined runs in accordance with some principle of electro-magnetic attraction.

IRON IN THE PUNJAB.

A LARGE quantity of native iron is brought from the interior to Simla, whence it is exported to the plains. The metal is in pigs, having been rudely smelted in smelting furnaces at a village distant about twenty miles from the station. The process of smelting is the common, rude and simple one that generally prevails throughout the country, and which, in case some of our readers should not happen to be familiar with it, may be briefly described. The workmen pound the ore into powder, and having made an oven of clay, round and open at bottom, and narrowed at top, with a hollow cylinder of clay in the centre, above the fire-place, they fill the cylindrical clay chimney with charcoal, and having fire underneath, they throw the powdered ore in small quantities on the charcoal in the chimney, and the melted contents fall into the oven, the mouth of which is closed up with clay to prevent any air getting in, except what is afforded by a pair of rudely constructed bellows, the quantity of wind afforded by which is remarkable. These pigs contain a great deal of dross which are taken out in the smelting furnace when prepared for running into moulds. That the foundry at Nahun has proved a failure is to be regretted. It was for a long time an expensive hobby of the Rajah's.

THE OIL-WELLS OF SOUTHERN RUSSIA.

THERE seems to be no question that the oil wells near the shores of the Caspian Sea in Southern Russia are fully equal in the profusion of their product to the great wells first discovered in Venango county, Pa., America. A young man who went from Clarion county to assist in putting down some wells with American machinery, writes home that the derricks are as thick in the developed oil territory as they were at Petroleum Centre in its palmy days. He says one well flows twice a week for four hours at a time at the rate of 10,000 barrels per day. In his own phrase, "the stream of oil running from her is as large as Hay's Run—a solid stream of oil, free from gas and froth, forced into the air to a height of 75 feet." He says the oil is allowed to flow upon the ground and collected in trenches dug to contain it. The wells are drilled and pumped in the most primitive and wasteful manner. The oil is transported in sacks made of hog-skins, and in rude barrels 5 feet long, upon carts with wheels 10 feet in diameter. The indications are that this Russian oil-field is as rich as the American. It is cut off from a market except by the roundabout navigation of the Volga and the Russian canals which reach St. Petersburg; but 400 miles of railroad, across the land that separates the Caspian and the Black Sea, will put it within reach of every European customer. A pipe line could be laid down which would carry the oil to the Black Sea at such a moderate cost of transportation as to distance American competition.

THE MINERAL WEALTH OF AFFGHANISTAN.

WHEN we were in Affghanistan before some trouble was taken to find out what mineral wealth there was in the country; partly with a genuine wish to see what could be made of it, partly perhaps to reconcile certain people at home who objected to war and annexation unless the profits could be favourably stated in pounds, shillings and pence. Captain Drummond, of the 3rd Light Cavalry, wrote an interesting report on the mines and minerals of Northern Affghanistan. His report deals chiefly with the copper mining districts in the Ghilzai country south-east of Cabul, and with the iron ores of Bajour. In the Ghilzai country the whole of the strata were found to be highly metalliferous; whilst the pine forests which stretch southwards from the Safid Koh would furnish plenty of wood for fuel. There was a lack, however, of running streams; whilst another hindrance to the success of mining and smelting operations lay in the unsettled state of the province and the lawlessness of large sections of the people, the predatory tribes infesting the tract between Ghuzni and Jollalabad.

The Planters' Gazette.

TEA.

PROSPECTS OF THE INDUSTRY.

TEA as an investment does not at this moment stand high in public estimation, and before proceeding further in estimating the present prospects of tea, it might be advisable to see if we can fathom the causes which have led to the present depressed state of market, on the principle that "a knowledge of "the disease is half its cure." There are doubtless many causes which have brought about the present deplorable condition of affairs, but it will perhaps suffice if we lay our hand on a few of them, in the meantime. We propose therefore making a few remarks on three, *the broker, the agent* and *the mode of selling in England.* A considerable amount of discussion has lately been going on about the broker, and we will take his case first.

The broker is an anomalous being who has followed in the wake of the tea enterprise, and who has done it much injury. We must not however be blind to the fact that he has at the same time done it much good. It may be admitted perhaps with some show of reason that whatever good he has been instrumental in doing may be attributed to the individual, while the injury may justly be debited to the system.

It is a truism, which we assume will not be disputed, that man's interest and his duty should coincide, and that where duty points in an opposite direction to interest, it usually has to succumb to the strongest motive. Now the broker, who is properly an auctioneer in charge of the seller's property, has a duty to perform to that seller, his principal, and that duty is to sell the constituent's goods at the best possible price he can obtain, and as he gets a commission for so doing, one would think that duty and interest for once ran parallel; and so they would, did the broker's functions end here, but while he is acting as agent for the seller, he frequently acts at the same time as agent for a buyer, nay worse, he is oftentimes the buyer himself. The temptation to please his new constituent by buying cheaply, and so secure commission from both sides, is great, and if a buyer himself, the temptation is overwhelming. In either case the seller's interest suffers.

The agent comes next to be considered, and here again it is the system we find fault with and not so much the individual, who is no doubt an "honourable man." The fault we find is that agents are usually selected not from any special qualification they may possess, fitting them peculiarly for the appointment, but because they can finance well. We also object to the mode of remunerating the agent. His interest is to meet the market without reference to the ultimate prospects of the Company, and we at present see the spectacle of managers being instructed to manufacture a crude and very inferior tea, because in the present disorganised condition of the home market such a bitter, pungent and altogether coarse tea is in request for flavouring cheap and inferior China teas. This action hinders the advance of Indian teas in home estimation, and is altogether demoralising to the trade generally, but then it brings present gain to the agents in the shape of good commissions. Now an agent should have absolutely no other interests than those of his principal. He should be a practical tea planter, capable of taking intelligent charge of everything, of seeing that the manager knows his work and does it, and of advising the directors, who are not expected to be experts. There are plenty of such men available, men who have spent years in the jungle, and who are yearning for a change to civilised life. His income should be a fixed one, and not dependent on the *gross* income of the company, a manager could not or rather dare not neglect his work when he has an intelligent agent at head-quarters to keep an eye on him, and given a good agent and a good manager, any tea concern is bound to succeed.

A third cause is the mode of selling in London. This opens up too large a subject to be taken up at the end of an article like this; let it suffice that we point out one blot, and that is the bulking of teas. If, to open a box here in this warm climate depreciates the value of the tea what must it be to have all boxes opened and contents left on the floor for days in warehouses in such a foggy climate as that of London?

Despite these drawbacks, which are not inherent to the tea enterprise, we look on the trade as a safe and a good one, and one that is bound to go on extending, provided always that common prudence is observed in conducting it. It has been said that the enormously increased and increasing supply must affect the price, but we do not find this to be the case, the present depressed state of the market being due to causes quite outside of this. In 1840 the consumption of tea in Great Britain was 1·22lb., per head. The population was than 27 millions; this represented a consumption of 34 millions lbs.. Now, with a population of 33 millions it is 4½lbs. per head, or about 150 million lbs., thus shewing an increase of 116 million lbs., while the tea from India has never gone above 35 million lbs. per annum. This does not seem to point to over production.

A Correspondent, writing from Cachar to the *Tea Gazette* says: "I have not yet seen any one who could tell, whether most tea can be got by leaving the leaf on the bushes till the third leaf matures, or by plucking only two leaves and a bud as is done this year. There is less tea this year than last, but I attribute this to four weeks of cold rain in July in addition to two weeks of general rain in June, as well as to finer plucking, *i. e.*, two leaves and a bud, which have been gathered this year as against three leaves and a bud in former years. The flushes have been backward in August and September from the long continued rain without sun in July, but spiders have not returned. It would be well if planters were asked to mark off a few acres next year, to try what difference in outturn of leaf there is between gathering two and three leaves and the bud during season. The prices of these teas could easily be ascertained and an average struck of profit and loss. On large gardens a hundred maunds or two, more or less, makes no appreciable difference on the total expenditure for the year. So far as I can make out now, last year I got a flush regularly three times a month by plucking two leaves and a bud; I have not kept a note this year. I think three leaves require a fortnight; I find it impossible to get any information about dates of flushes from our neighbours."

This is an inquiry of a very important nature and the answer admits of a variety of opinion. We shall be glad to have the views of planters on the subject. We shall also be glad to hear now and again from planters on other subjects connected with their special profession and have only to ask that such communications be short and practical, our desire being to disseminate information that will be useful.

A Correspondent in Ceylon writes:—"Tea still keeps well to the front, and now that the Ceylon Company Limited, has started a factory in Colombo for curing, &c., we shall be seeing it appear regularly among the exports of the island. I have heard that this agency has already cured and despatched about 20,160 lbs. and has every prospect of doing a good business. At Avisawella, the land of the elephant and the scene of many a kraal, the young tea plant is said to grow in quite an amazing way. Nursery plants have grown to the height of six feet in eighteen months, and seed planted in April of this year produced plants one foot high which were planted out in July. About Avisawella there is abundance of suitable land for carrying out this new enterprise on a large scale, and the rainfall on which the flushes so much depend, is very great, and well distributed over the year. Indeed, there is never a month in which a fair amount cannot be registered. An average of five years from 1871 to 1875 inclusive, shows 160·13 inches, and as there is also plenty of heat—Avisawella being in the lower country—the most important factors are present for the vigorous growth of vegetable life."

COFFEE.

WEEDS ON COFFEE ESTATES.

To keep an estate free from weeds has always been found one of the most difficult and trying operations to the planter. But weeding is an indispensable operation in successful coffee culture. An estate overrun with weeds is a sure sign that it is under lazy and careless management, and on seeing such an estate a careful planter will exclaim, "That estate is going to the dogs." And yet in the present advanced stage of coffee-culture in South India with the experience of many years to guide them, we find that, some planters actually are so reckless as to assert that weeding is all a mistake. A correspondent of the *Madras Mail* recently aired this opinion in the columns of our contemporary, but, after a careful perusal of his arguments, we have no hesitation in stating that these arguments have not a leg to stand upon. He asserts in the first place that the rich soil of the Neilgherry sholahs is simply the accumulation of generations and generations of dead weeds. In the next place he maintains that the soil of an estate must be very poor indeed if it cannot support a single generation of weeds in addition to growing coffee. His theory is that the weeds deprive the coffee of but a very small proportion of the constituents of the soil; on the other hand, when the weeds are buried annually they return to the soil what during life-time, they had taken out of it. Now, without going into the question as to what the soil of the Neilgherry *sholahs* is composed of, it is clear that at the present time it is utilised for the cultivation of *coffee*, and not of *weeds*. The object, then, of the cultivation must be to give the coffee the full benefit of the soil. The *Mail's* correspondent, however, maintains that weeds grown with coffee eventually act as manure when buried annually in the soil. This argument, on the face of it, is ridiculous and illogical. No sooner is one crop of weeds pulled up than another will sprout; will not that new crop have to share the manure of the soil with the coffee? What advantage, then, is this annual burial of weeds supposed to bestow on the coffee?

In previous issues of the *Chronicle* we have dwelt at length upon the subject of weeding. In our present issue we will offer but a few remarks upon the advantages of the operation. In the first place, weeds, particularly *hurialli* grass, the wild brinjal, and some other species, absorb no small proportion of the constituents of the soil which should go to enrich the coffee tree. Then they seriously interfere with the spread of the coffee roots, and, choking the stump of the coffee tree, prevent the free circulation of air, and the admission of sunshine underneath its branches. In all the various estate operations of pruning, manuring, draining, &c., weeds harass and impede the cooly in his work. We have only to look at some of the native estates in Coonoor, Wynaad, and Mysore, to note the mischief, loss, and sometimes absolute ruin caused through neglect of periodical weeding. After all, to a zealous, careful, and pains-taking planter, weeding is not so troublesome and laborious an operation, as it is represented by some to be. He knows that his coffee trees can no longer be healthy and thrive than he himself can hope to do if he did not wash himself at least once a day. Weeding might be a little expensive at first, but the result in the end will be such bountiful crops as will abundantly repay the planter the outlay.—*Madras Times.*

IN BANGALORE.

OLD residents will tell those curious to know that some thirty or forty years ago, nearly every garden or compound in this station had its complement of coffee trees which throve and yielded well. Latterly, however, the coffee tree has been rooted out to give place to the grafted mango, apple, peach, &c., which have been proved to be more profitable as claiming ready sale. But those interested in the growth of coffee in Bangalore, may learn that some plants, in excellent condition and now in the first year of bearing may be seen in the garden of Mr. Ricketts, Deputy Commissioner on the High Ground. The plants, about a dozen in number, are very healthy and strong, the lower branches being loaded with berries now ripening. We do not say that the plant will yield as abundantly as it does in a higher latitude, but certainly, with a little care and attention coffee growing in Bangalore would pay all cost and leave a margin for one's trouble.

LEAF DISEASE IN THE NEILGHERRIES.

LEAF disease appears to be spreading on coffee estates situated on the northern slopes of the Neilgherries. This part of the district, it will be remembered, suffered very much from the drought both of 1876 and 1877. The manifestation may be regarded as the result of an abnormal degree of dyness in the air and in the soil. The leaf disease appears not only on the coffee bushes, but occurs in the orange groves, it has been observed in the sweet-potatoe and wild growth, and forest trees show symptom of being affected. The orange leaves when affected are covered with a white powder and drop off the branches in all stages of growth.

PLANTING NOTES FROM CEYLON.

Central Province, 14*th Oct.*, 1878.

AS far as the weather is concerned planters here have no cause of complaint, for we have both rain and sunshine, and the former especially is welcome to help forward the crop on heavy laden trees. It is quite wonderful how much of what may seem almost hopeless coffee—good evidently for nothing else than stripping—turns colour under the benign influence of sunshine and shower, even although there may be only the rag of a leaf fluttering on a branch, here and there. Closse picking, too, does much to relieve the struggling plant, but this brings on the certainty of having a higher percentage of skinned beans than desirable, for the coolies will not, or cannot, always discern between what will pulp well and what will not. Of course, it is just a question for the individual planter to decide how far or how long he should continue the risks of close picking. Reports of crops from the higher districts are more favourable, and some of the young estates are expected to do very well indeed, but the lower places, as a rule, 'sing small' which does not argue much, for while the planter can grumble with the Briton's vigour, he can also talk loud enough when the luck runs with him. As the showery weather has been pretty general, late planting and supplying will have more than the average chance of succeeding

Leaf disease is said to be on the decrease in several of the districts, and it is quite time, for the estates which have been favoured with a visit can testify, by the way the ground is littered with leaves, and the general greyness of the coffee, that the visit has cost them much. The upper districts, however, have not suffered to such an extent as the lower and older ones, and there is a belief abroad that there is a zone in coffee above which the fungus is to a certain extent innocuous. I trust this will prove to be true, but it is not by any means a settled point, and, indeed, unless I have been misinformed, the Director of of the Peradenia Gardens is of opinion that no such expectation can be realised. It is only a matter of time—the estates being new and the soil unexhausted give them their present advantages, but when these advantages have been overtaken the high coffee will suffer quite as much as the lower. Planters, however, are not of this opinion yet, and the fact that two young estates in Dickoys have lately changed hands at high prices speaks of a confidence in the future in some quarters which is not felt in others.

THE LIBERIAN PLANT IN COORG.

A CORRESPONDENT in North Coorg writes:—It may interest you to hear that on the next estate to this a Liberian coffee tree has come into blossom; this estate is partly in Coorg and partly in Munzerabad, and is at an altitude of over 3,000 feet; the estate on which the Liberians have blossomed is at about the same elevation perhaps a couple of hundred feet lower, but over 3,000 feet, and is in Munzerabad. Have you heard of any instance of the Liberian coffee blossoming at so high an elevation before?

COFFEE FREIGHT.

THE season for shipping from the Western coast is not far off. The "Curers" must be looked after this year, and not left to themselves as last year to run up freights to 75*s.* from 55*s.* At the former freight one steamer booked more than she could take, while the "Canal freight" in Bombay during the season varied from 20*s.* to 35*s.* According to Bombay Market Reports, freight from Bombay to London is 12*s.* 6*d.* per ton. In Colombo the rate is 40*s.* to 45*s.* for Coffee in Bags. Under these circumstances and in the interests of the planting community, we think that a combination on their part ought to be made, so as not to allow coast houses to send their coffee at such widely differing prices as 75*s.*, 55*s.*, 35*s*, 20*s.* and 12*s.* 6*d.* per ton. On the face of it, the matter looks suspicious. And for any agent on the coast to write to a planter charging the highest quotation, while he knows very well he can send his coffee off at the lowest rate, savours of a bonus as well as a commission. However, it is our duty to speak out in the interests of the planters, and we have done so; we hope in time to abate this flagrant jobbery.

EFFECTS OF ELECTRICITY ON PLANTS.—The following are the result of careful researches made by M. Grandeau into the subject of the influence exercised by atmospheric electricity on the nutrition of plants. 1st. Atmospheric electricity is an important factor in assimilation in vegetable life. 2nd. Plants submitted to its influence elaborated in a given time, other conditions being equal, from 50 to 60 per cent., less of living matter than those whose growth proceeded under ordinary circumstances. 3rd. Vegetables but slightly elevated above the level of the soil are equally influenced by atmospheric electricity. 4th. The percentage of protein matter formed does not appear to depend sensibly upon atmospheric electricity. 5th. The percentage of ash is higher in plants that have grown unexposed to it. 6th. The percentage of water is less in such plants.

TEN VARIETIES OF COFFEE.

THE *Ceylon Observer* has been furnished with the following interesting paper on varieties of coffee, their characteristics and their cultivation, by the Government Botanist of Trinidad. If Mr. Prestoe's conclusions are correct several of the varieties of coffee he describes (and he dwells strongly on their permanent distinctness) would seem to be eminently worthy of attention in Ceylon, where the ravages of leaf disease have strongly suggested the remedy of "new blood." As yet experience in the introduction of any other coffee than that which has been for centuries, probably, grown in the Island, since the Mahomadan voyagers brought seeds from Arabia, has not given marked results,—except in the case of the Liberian species. That is distinct and likely to remain so, but seeds obtained from Mocha have given a coffee which gradually approximated to that obtained from locally grown seed. Why in Ceylon there should be so few of the form of tree known in Southern India and anything but favourably under the name of "chick,"—distinguished by the upwards instead of the horizontal tendency of the branches and its habit of bearing a full crop only once in two seasons,—is a question which remains to be solved. But according to Mr. Prestoe there are ten well-marked varieties of coffee grown in the Trinidad Botanic Gardens, some of which are adapted for poor soils and climates distinguished by drought.

Trinidad, 16*th April*, 1877.

The attention of parties interested in the cultivation of coffee is specially called to the several varieties of coffee in the Botanic Gardens—some of which are new to the Western tropics.

They are :—

No.	1	Liberian	*Coffea Liberica*	W. Ct. Africa.
	2	Cape Coast	„ *sp.*	„
	3	Narrow-leaf	„ *angustifolia*	Java.
	4	Eden	„ *sp*	„
	5	Mocha Retziel	„ *sp.*	„
	6	Emzadiji Menuda	„ *sp.*	„
	7	Souffriere	„ *Arabica, var.*	Dominica.
	8	Mocha	„ *sp. var.*	*major*
	9	„	„ *sp. var.*	*minor.*
	10	Bengal	„ *Bengalensis*	Bengal.

Of the foregoing, those which have been propagated and are now offered for distribution, together with their prices, are as follows :—

Liberian	*Coffea Liberica*		... 25c. each
Narrow-leaf	„ *Angustifolia* ...		... 25c. „
Souffriere	„ *Arabica, var.* ...		... 10c. „
Mocha	„ „ *vars.*	*major* *minor*	Price as per quantity, down to 2½c. each plant.
Bengal	„ *Bengalensis* .		.. 10c. each.

In view of affording information that may be desired respecting those offered for distribution the following explanatory notes, are submitted :—

1.—LIBERIAN COFFEE.—This extraordinary coffee has become generally known to Colonists from the accounts given of it in the newspapers ; the large size of the bean, and the high prices realised for this coffee having first attracted the attention of persons desirous of promoting coffee cultivation in the British tropical Colonies

It is indigenous to the West Coast of Africa, about Sierra Leone and Liberia, where it appears to be almost the only kind cultivated and with much success, in the hot and moist lowlands or hills of no great altitude. It is, therefore, eminently valuable for cultivation in a tropical colony where these conditions exist so extensively as here. Neither a constant moisture nor rich soil appear to be indispensable however ; these conditions do not exist in the Botanic Gardens in a degree beyond what is commonly met with throughout the island, but the progress of the Liberian coffee plants—planted there in July, 1875—and their present state, are all that can be desired ; the leading plants being over [illegible] feet high and having already flowered. So that this variety of coffee may be regarded as a perfectly safe and most valuable introduction to the island.

The soil in which the plants in the Botanic Gardens have thriven, is the ordinary red gravelly loam, or clay-like deposit, found associated with quartz and schist throughout the Northern part of the island.

The plants now offered for distributions, have been raised from seeds received direct from Liberia ; and having been grown in pots they can be transmitted at a trifling cost to any part of the island, or the West Indies, without damage to leaf or root.

A glance at the Liberian coffee plant impresses one with the great difference in the character of the plant and that of the common or Creole coffee, and suggests a method of culture somewhat different. It may be useful to point out however, that with a size and general robustness of habit, at least three times that of the ordinary coffee, it evidently does not reach the stage of full fruitfulness so early, although its first flowers are produced quite as early.

It assumes the character of a small tree much more distinctly than any other of the better known varieties. Its first branches and leaves are few and gross, becoming smaller and more numerous and dense with age, exactly as occurs with many of its near allies (*Rubiaceæ*) so abundantly present in the minor woods and thickets of this island.

These peculiarities indicate that a system of rather wide planting must be resorted to, and such treatment in pruning as will induce a lateral development, *viz* : topping the leaders *permanently* at 7 feet, and the leading branches, (laterals) first at 3 feet from the stem, and successively at 1 and 2 feet at subsequent toppings, when the growth does not promise to be sufficiently dense.

I should recommend planting at a distance of sixteen feet apart, and interlocating the common Creole coffee—which luxuriates in a slight shade—to aid in effecting a speedy furnishing of the ground and quick return of produce. These intermediates to be removed as the increased spread of Liberian plants may necessitate—probably in the sixth or seventh year when the ground will have become completely covered.

2.—THE NARROW-LEAVED COFFEE—received from the Java Botanic Gardens—is probably quite as new to Western cultivation as the Liberian. It is clearly a species of coffee eminently adapted for cultivation in poor rocky or gravelly soils. It resists drought that would prove fatal to the ordinary Creole coffee. Its prolificness is very remarkable, and the size of bean only second to that of the Liberian, but it is slower to develop than the ordinary coffee.

Its foliage is remarkable from being sparse and drooping, the leaf being much longer, but only one quarter the width of an ordinary Creole coffee leaf and of very leathery texture. These characters indicate that it is adapted for dry and hot localities, as well as for resisting attacks of fungoid and insect blights to which the common and Mocha coffees seem becoming more and more liable.

I should recommend the plants of this species to be planted at a no greater distance than six feet apart. It does not appear likely to exceed a height of four or five feet, a habit growth which, together with its sturdy branching, renders topping or pruning unnecessary.

3.—SOUFFRIERE COFFEE.—This coffee has been so named from the district in which I found it growing in Dominica. My attention was attracted from a distance to trees of this variety on the Souffriere hills, by their uniform fruitfulness and health, while being surrounded by trees of Creole and Mocha coffee, all more or less affected with blight and impoverished by drought and barren soil. On examining the trees I found they were quite distinct from any other variety I had yet seen—in the general sturdiness of habit, distinctly pendulous branch, deep green of the foliage, and the leathery texture of leaf. Moreover, the trees were evidently proof against insect attacks.

Growing among trees of Mocha and Creole coffee—which like themselves, had not been pruned for years, the habit of growth or shape was the perfect spherical bush whereas the other trees had assumed the utmost disorder in shape.

The size of the bean of this variety is unusually large, nearly equalling that of the narrow-leaved coffee.

This variety is eminently adapted for cultivation on steep and barren hill sides where, although less hardy than the narrow-leaved species, it will develop much more quickly, and thrive when the Creole coffee would fail.

1.—MOCHA—*Vars. major and minor.*—The variety I distinguish as minor in the Botanic Gardens was formerly cultivated in the Maraval, St. Anna's [illegible] Valleys, where trees are still to be met with. It is the inferior of the two varieties in robustness of [illegible] and size of bean.

The bean of variety major is as round as, and a third larger than, that of minor. Moreover, the rate of growth of the former is much faster than that of the latter ; at the same time it is more prolific.

The two varieties were planted side by side in the Gardens, in July, 1875, and are now in full bearing, but var. major is seven feet high, whereas var. minor is but four to five feet.

The conditions of soil and climate of the Northern hills and valleys of the island are eminently suitable for the cultivation of these two varieties of coffee—var. major for the lower, and var. minor for the upper parts ; and, except in the poorest and most exposed surfaces, they would become most prolific under full exposure—after being established by aid of shade, afforded by small trees, or temporary cultivations, such as pigeon peas, &c. It does not appear to be generally known that the Mocha coffee is rendered most prolific by scorching sun-heat, up to a point of making the trees lose their leaves to some extent, and thus it is that in the East the operation of gathering is often effected by drawing the branches through the hand, not picking the berries off the branches. Moreover, Mocha coffee trees in this island are often seen in the leafless condition alluded to, laden with fruit.

5.—BENGAL COFFEE.—This variety differs from all others in its excessively compact habit of growth, its small and long bean, and specially in its adaptability for cultivation under other trees—luxuriating and being most prolific in dense shade.

It is a second class coffee in the market (chiefly owing to the shape of its beans) but it is to be recommended as a variety for planting with cacao—*i.e.* in rows, intermediate with the rows of cacao trees, where the conditions would exactly suit it, and its compact habit of root, as well as branch, would leave it harmless to the cacao.

As there are signs of the valuable coffee cultivation being resuscitated in the island, and in view of high premiums being offered this year by the Society of Arts Committee, for the best productions of special or new cultivations carried out on a considerable scale, it is especially desirable that the advantage of a knowledge of the different varieties of coffee should not be overlooked.

It seems to be a common impression that there are but two or three varieties of coffee in cultivation, whereas there are nearly as many as a dozen—many of which are botanically distinct species.

The different degrees of excellence in quality of coffee is largely due to variety as in the case of cacao—or, indeed, almost any other kind of produce—a fact which is very generally overlooked by growers of cacao and coffee.

It is of importance also to consult the variety in reference to the conditions of soil and climate presented in the locality where the cultivation is to be carried on.

That there is a very wide field for choice, in this respect, is evident in the great variation presented in the eleven varieties—some of which are distinct species—growing in the Botanic Gardens.

Some of these are from Java—whence several other varieties are to be obtained since seeds of such have been received, but have failed to grow.

A notion very commonly exists that high-priced coffee can be produced only at an elevation of three or four thousand feet, and the statement is made use of against Trinidad ever becoming a coffee exporting Colony on a large scale; but even if it were correct that high-priced coffee depended more on elevation than careful preparation, the argument is fallacious, since it is now established that there are varieties producing coffee of high excellence suited to every elevation and condition usually met with in the tropics, and that the finest coffees are produced at low, as well as at high, elevations.

Abundant proof of these assertions is afforded in the facts—that the coffee trees, in different parts of this island, thrive and fruit to perfection; that the native grown coffee, at the Society of Arts Exhibitions for the last twelve years, has been of excellent quality; that ten *kinds* of coffee are thriving to perfection in the Botanic Gardens; that Mocha coffee produced there has been pronounced equal to the best to be obtained.

It should be stated that Mocha coffee plants planted in July, 1875—then about one foot high—are now over seven feet high, thickly branched and laden with berries.

This rate of development, however, I have seen surpassed in the Aripo districts. There, a squatter cleared his land, planted coffee "slips," and had coffee trees, five feet high and bearing berries, in one year!

There is scarcely any part of the island where coffee cultivation could not be carried on profitably, but I regard the districts of Maracas, Aripo, and North Oropouche as presenting conditions for coffee cultivation that are not to be surpassed.

HY. PRESTOE,
Government Botanist.

COFFEE MACHINERY AT THE PARIS EXHIBITION.

DEAR SIR,—During a short visit to Paris just lately, I took the opportunity of somewhat hurriedly inspecting the various samples of coffee to be seen in the Exhibition, and I venture to think a short account of them will not prove uninteresting to your readers.

The varieties grown in Portugese colonies were extremely numerous, and although some of the samples were very good, they lacked colour. This fault was evident in the Dutch samples and also in many produced in English Colonies

That the gold medal and diploma of honour have been awarded to the Guatemala Government for their exhibit of coffee excites neither jealousy nor wonder in the minds of, those who are capable judges and who have examined for themselves the truly magnificent array of samples which have gained this great distinction. The beautiful color and bright, polish on the berry were matters of general comment, and in colour and shape it was equal to any mountain in Ceylon. These results were in a great measure due to the machinery employed in preparing the coffee, and which is to be seen in full work in the central American section, being exhibited by Messrs. John Gordon & Co., 8 New Broad-street, London a firm who have been connected with Ceylon for very many years.

This machine consisted of a double peeler, that is one circular trough on the ground floor and another one on the floor above, the crushing wheels being worked from one upright shaft.

These two peelers had a continuous feed and discharge, the coffee first running into the trough on the upper floor, passing thence through a small fan into the trough on the ground floor, where as regards peeling and polishing it was finished.

By means of elevators the coffee was delivered into a second fan, which discharged the coffee into the sizers and peaberry separators. The latter machine consisted of cylinders and performed its work in a most satisfactory manner.

The coffee which obtained the gold medal was all passed through Messrs. Gordon's peelers and separators and the process was to be seen at work. The Guatemala Government supplied the dried cherry as well as the parchment, and there is no doubt that the manner in which the coffee was treated by these machines contributed in a very great degree to the success achieved by the Central American Republic.

Messrs. Gordon & Co. received the only medal awarded for coffee machinery at this exhibition, so doubtless their machinery in the best, and does not break the coffee.

W. SMITH.

A NOVEL PRODUCT.—Coffee as an outcome of the bunya-bunya tree, is one of the novel products that was exhibited at the Exhibition of the National Association, Queensland. The seed of the bunya is used, and has been used for years. It is roasted and ground as ordinary coffee, and is said to make a substitute of such excellent quality that those who have used the article prefer it to genuine Java.

CINCHONA.

THE CINCHONA PLANTATIONS.

(*To the Editor of the Madras Mail*)

SIR,—It is some time since the Government ordered a special report on the Government cinchona plantations on these hills; and rumour says the report went in a long time ago, that the Alkaloid Committee have finished their labours, and yet the Government give no sign. Its surely is strange that though these reports have been before Government for some time, no orders have been passed. Does the Government really intend to continue the suicidal policy of leaving these plantations under inexperienced hands, and thus in a measure defeat the object for which they were formed, *viz.*, the propagation of the finest kinds of cinchona, and the development to the utmost by scientific management of the production of quinine.

For fifteen years, we have had no reports on these plantations by a properly qualified officer versed in arboriculture, and the cinchona growing public are actually in the dark as to the best kinds to grow at different elevations, and the best method of producing the greatest amount of quinine. Here and there in various reports, we have surmises, hints, and results of limited experiments, but up to date no summary of operations, no practical results on a large scale, in fact nothing sound to work upon. Here are large plantations giving a steady return at present, of some three lakhs of rupees, which might soon be doubled by skilful treatment, left almost to take care of themselves. The Government is not only losing a large sum of money, whilst it delays placing a proper officer in charge, but much valuable time is lost in developing the quinine producing resources of these hills. Let the Government no longer hesitate, but appoint an officer versed in arboriculture to the charge of these plantations at once. Probably they could not appoint a better man than the officer who was selected to carry out the enumeration, and submit the special report; his qualifications are generally admitted, and the appointment would give satisfaction. The cinchona growing public are anxiously awaiting the publication of his report on the plantations, also that of the Alkaloid Committee, who, in spite of orders, have, it is rumoured travelled out of their way to give their opinion on the cultivation, state of the trees, and best mode of managing the plantations though quite incompetent to do so. It is high time this kind of interference was put a stop to.

26th October. COMMON SENSE.

SERICULTURE.

EXHIBITION OF SILK COCOONS AT NURPUR, IN THE KANGRA DISTRICT.

No. 885C., dated Lahore, 4th October 1878. From—Lepel Griffin Esquire, Officiating Secretary to Government, Punjab, To—The Secretary to the Government of India, Department of Revenue, Agriculture and Commerce.

I am desired to forward, for the information of the Government of India, a report on the exhibition of silk cocoons held at Nurpur, in the Kangra district, submitted with the Financial Commissioner's letter No. 960, of the 26th August last.

2. The memorandum of Mr. Francis Halsey, which accompanies the report, is of considerable interest, and the Lieutenant-Governor would especially desire to record, on the occasion, his sense of the loss which the Province has sustained in the death of that gentleman from typhoid fever in August last at Venice. No unofficial Englishman has laboured with more interest and success to improve the native industries of the Punjab, and his enlightened exertions for the improvement of the breed of cattle, the introduction of new staples, the development of sugar manufacture, the rearing of the silk-worm, and the manufacture of silk, have been on many occasions, and in various reports, brought under the notice of the Government of India.

Mr. Francis Halsey, by his honorable and energetic character, had justly gained the complete confidence of the people of that part of the country in which he lived; and the Lieutenant-Governor believes that his loss will be deeply felt both by the Government, whose efforts he was always ready to second, and by the people, in whose welfare he took so warm an interest.

No. 617, dated 5th July 1878. From—Colonel C. V. Jenkins, Deputy Commissioner, Kangra, To—The Commissioner and Superintendent, Jullundur Division.

I beg to inform you that on the 14th May last I held the usual *jalsa*, with reference to the annual sericulture show in Nurpur.

2. The following gentlemen were kind enough to attend, viz.:—

Mr. Halsey, Colonel Stenhouse and Mr. Langdale.

3. Mr. Halsey, as heretofore, was the chief conductor and manager of the affair, and most willingly and kindly gave me the benefit of his experience and able judgment on the occasion. I would feel obliged to you if you will convey the expression of your thanks to this officer who, at much personal toil and exposure, tested the qualities of the cocoons brought in for exhibition as well as for prize competition on the occasion.

4. The tahsildar, Moti Ram, also showed much energy and interest in the scheme and its general and further development, and I would request your favorable notice of this official also.

5. A copy of Mr. Halsey's able and full report embodies every thing so clearly, that I can add nothing more than say, in attaching it, I have had its purport fully translated and explained in the vernacular, and that it is my intention to endeavour to carry out all his suggestion as far as may be in my power to do so; and I would especially draw attention to the generous offer contained in paragraph 7 of Mr. Halsey's memorandum referred to, in which he states he will give Rs. 1,000 in prize in December 1880—one for Rs. 500, and two for Rs. 250 each—to any three plantations which may show the best as regards the cultivation and produce of the China and Philippine Islands mulberry trees.

6. With these preliminary observations and remarks I will proceed to report on the *jalsa* of May 1878, held under my presidency.

Last year the cocoons, *i. e*, for 1876-77, were produced as follows:—

Kangra district	42 persons.
Other districts	22 ditto.

The present year's competition showed :—

Kangra district	70 persons.
Other districts	65 ditto.

making a total for 1876-77 of 64 competitiors, against 135 in 1877-78, the year under report.

There was, therefore, an increase of competitors over and above last year's number as follows:—

Kangra district	28 persons.
Other districts	43 ditto.

This is favourable, and shows that year by year the scheme is creating greater interest.

Cocoons in the year under report were produced, weighing 8 maunds 29 seers and 4 chittacks from Kangra, and from other districts, 2 maunds 25 seers and 12 chittacks.

This year's weight of cocoons has exceeded last year by half as much again.

7. Last year Rs. 805 cash was given out in prizes, as follows :—

	Rs.
In advances	100
Prizes	[illegible]

Out of the money given away in prizes last year, Rs. [illegible] fell to the Kangra district, and Rs. 80 were distributed in prizes to other districts.

This year I gave out a sum of Rs. 751-6-0, as follows:—

	Rs.	A.
Advances	184	0
Miscellaneous expenditure, for watering ...	15	0
Hire of coolies, with mulberry cuttings from Madhopore	1	8
Arrangement of rooms for *jalsa*	11	0
The rest was distributed in prizes of two classes—		
First—38 competitors of cocoons	405	0
Out of which 27 were from Kangra and got ...	315	0
And the eleven from other districts ...	60	0
Second—Presents to zaildars, kotwals and other officials	135	0

I am satisfied that the vast improvement in the show this year, as compared with the last year, has arisen from the interest taken by the tahsildar especially, and the zaildars and kotwals generally, throughout the year, and for this reason I presented them with *khilats* as a stimulus and example to others.

8. I was glad to observe that a few Hindus of Nurpur embarked in the scheme, such as Bisen Das canungo of the tahsil, and others. This is a step in the right direction, because hitherto they had some absurd prejudice, that to be mixed up in any way in such an enterprise was opposed to their caste.

The actual produce in silk this year was 3 seers and 12 chittacks from the Kangra district, and 4 seers from other districts, but the produce was of such a coarse and inferior kind, that Mr. Halsey (acting as umpire or judge) decided that it was not worthy of either praise or prize.

9. In conclusion, I would state that I consider the whole thing was more than a fair success, and that I have every hope it will equally further develop itself year by year, and will, in the end, afford an easy means of provision as well as an occupation for the children and women appertaining to the poorer classes in the district. The great point which made this year such a success over the last was, that through the medium and instance of Mr. Halsey 10,000 mulberry cuttings of the China trees were planted out in the Nurpur and Kangra ilakas.

Memorandum by J. Halsey, Esquire, dated 17th May 1878.

At the request of Colonel Jenkins, the Deputy Commissioner of Kangra, I had much pleasure in attending the exhibition of cocoons held at Nurpur on 14th instant.

1. There were 70 exhibitors from the Kangra district and 65 from other districts, as compared with 42 and 22 respectively, last year.

The quality of the cocoons was far superior to those of the previous year, but I fear the greater number of cocoons were exhibited for the sake of the prizes rather than as samples of cocoons raised for sale. The cocoons raised in the Gurdaspur district were considerably superior to those raised in Kangra. This may be accounted for by the fact that the rearers have been longer at work in the former district, and consequently understand their business better.

2. The exhibition excited far more general interest at Nurpur than at Gurdaspur. This may be accounted for from the fact that in this new trade the poverty-stricken inhabitants of Nurpur see a means of reducing their sad position, also from the interest taken in the matter by Colonel Jenkins and the tahsildar, Moti Ram, also by several of the kotwals and sahukars of Nurpur.

3. The pergunnah of Nurpur is far better adapted by nature for the purposes of sericulture than the greater part of the Gurdaspur district. There are many tracts of land unfit for cultivation from irregularity of feature and other causes, in which, however, the mulberry would grow, and there is no doubt whatever in my mind that the whole of the land revenue of the pergunnah could be paid from proceeds of the cocoon crop if only the zemindars could be made to see the advantages to be gained. To a zemindar there is no cash outlay whatever in producing cocoons; he has sheds already; he has his ploughmen to do the hard work of bringing in the mulberry leaf, at a season of the year when they are comparatively unemployed; for it must be remembered that the cocoon of the annual silkworm is ready about ten days before the barley harvest commences; he has the members of his family who can tend his worms, and finally he can have plenty of mulberry leaf without paying for it. The pursuit of silkworm rearing is carried out by agriculturists only in other countries where it is a staple.

4. As is the case in the Gurdaspur district, so are some difficulties to be found in Nurpur; it is some two degrees too far south to raise the silkworm without risk, unless there be quantities of the Chinese mulberry. This tree producing its leaves some 15 to 20 days before the common mulberry of the country, enables the cocoon to be ready the same number of days earlier than if the silkworm had been fed on the common mulberry, and the result is the dangerous days coming between the 8th and 15th April are escaped.

5. I can only repeat here what I have said so often before, viz., that to make this enterprise a success the people must take to it in a business-like way. They must rear a small quantity of worms such as comes within their means; that is, they must attend to quality and not quantity. An old woman and her son can tend the worms produced from half a chittack of eggs, which, if properly looked after, will produce a maund of live cocoons worth Rs. 30 to Rs. 40, quite sufficient to keep the

during the remainder of the year, and this in 40 days with no cash outlay whatever. What happens is generally in this wise: we will say the old woman and her son have earned Rs. 40; the following year comes round, and they argue that if they receive Rs. 40 from their half chittack of eggs, they can earn hundreds of rupees from an increased quantity of eggs; they have not a farthing in the world; they cannot engage labour, and without it and increased house-room there is no chance of their increasing their production; they try, in fact, for more than is within their power, and they lose all. The main fault of silkworm reared lies in this.

6. Consequently, I would urge upon those interested in the progress of this industry in the Kangra district to impress upon the people the necessity of planting the Chinese mulberry. I gave during the past winter many thousands of cuttings of this plant to all who asked me for them, and I was glad to hear from the tahsildar of Nurpur that most had struck; from these hundreds of thousands of plants can be made next year, and I shall be happy to distribute more to all who come for them next December. But I am strongly of opinion that some further incentive is necessary to make the zemindars take to planting the Chinese mulberry. Government has very kindly agreed to relax their demand for land revenue up to Rs. 80 in each village on land planted with the Chinese mulberry, which, as a rule, would represent some 25 acres of land, which would be capable of producing Rs. 1,500 worth of cocoons every year—a sum far beyond the zemindar's sanguine dreams. But amongst a race so unimaginative as an Indian zemindar some other means must be taken, and I think direct prizes will be best. The cuttings put down in December and January of one year, if properly attended to, would be young trees of 3 to 4 feet high, and even more, in twelve months, and from them a crop of leaves might be taken as they burst into leaf, that is within 14 months of the time the cuttings were first put down, and I would propose that prizes be offered to those who would put under the best mulberry cultivation a piece of land not less than 2 ghomaos. I am of opinion the prizes should be few but large, sufficiently so to make the largest and richest zemindars compete for them. It is true all cannot gain the prizes; but our purpose would be gained, the mulberry plantations will be in existence, and the zemindars, in order to make use of the leaf, would either take to rearing silkworms themselves or locate others who would.

7. I shall be glad to assist to this end, and would ask the Deputy Commissioner of Kangra to accept from me three prizes, one of Rs. 500, and two of Rs. 250 each, to be given to the three best plantations within the Nurpur purgunnah, each of not less than two ghomaos in extent of the Chinese and Philippine Island varieties of mulberry, the plantations to be inspected and prizes distributed in December 1880. This will enable all to compete, and the plantations to be in full bearing.

8. If the Kangra authorities thought right to distribute lesser rewards among the most deserving of the disappointed competitors, I think the result would be still greater. If the Deputy Commissioner will accept my offer, I would ask him to give the widest circulation to its conditions within the area affected by the competition.

Whether prizes might still be given in the meantime for cocoons, I will leave to others to decide. I think it would be well.

9. Regarding silk reeling: it is an axiom in the world that it is better to see the cocoon than to reel the silk from it. Economically the loss by reeling silk the native way is great: from the same cocoon from which a native reels silk worth Rs. 10 per seer, a European with proper machinery can realise silk worth Rs. 40 per seer. In the latter case, the gain to this country is direct and complete, as payment is remitted to this country from abroad, not only for the cost of producing the cocoon but for the labour expended on reeling the same; whereas in the case of native reeling the value of the silk is a mere transfer in this country from one pocket to another. I should be sorry to stand in the way of a possible native industry if I thought it could become a large one, but in my opinion it cannot, because, the demand for silk such as natives reel is very limited, being confined to one town in India, with a market which is soon satisfied; whereas the European market, although too full sometimes, will always absorb silk; besides the same people who would reel an article worth Rs. 10 can be employed under European management to reel an article worth Rs. 40. Again, in my opinion, cocoons to be a success must be produced by zemindars, who have neither the leisure nor inclination to take to such a handicraft as silk-reeling.

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INSURANCES are granted by this Company on nearly every description of Property in Bengal and Up-country.

For rates apply to

KETTLEWELL, BULLEN & CO.,

Agents in Calcutta.

SPECIAL NOTICE.

COMMERCIAL UNION ASSURANCE COMPANY.

Capital £2,500,000—Established 1861.

Paid up Capital	...	...	... £250,000
Invested Funds exceed...		...	... £1,550,000

LIFE DEPARTMENT.

Rates of Premium for India.

THE Directors wish it to be understood that the Indian rates of Premium published by the "Commercial Union" *are based upon actual mortality that has prevailed in this country for a series of years* with the addition of a moderate percentage only to cover Office expenses. Judging from their own experience, *it does not appear* that these rates are higher than the additional risk of residence in India demands, and this opinion is *confirmed* by the records of a Company that for a considerable period transacted the principal Indian Life business which records the "Commercial Union" Office has had the advantage of examining.

The Directors *think it right to offer this explanation* that the public may be aware that *the question of consenting to a general reduction in rates* has not only *not escaped them*, but has received *their earnest consideration*.

The following figures are submitted in support of the above :—

On English assured Lives the Annual Average Mortality from	20 to 50 is ·94	per cent.	
On the experience (Civil) of the Bengal Fund (1850-72)	Do.	1·30	,,
On the experience (Civil) of the Madras Equitable Society	Do.	1·41	,,
On the Experience (Civil) of the [illegible] Albert Assurance Co.	Do.	1·75	,,

This proves conclusively that the average of Indian Premiums for European Lives should be at least 50 per cent. higher than English rates, and the Directors therefore look with confidence to the public to support the "Commercial Union" Company which declines to accept insufficient Premiums for the purpose of attracting new business, but simply demands a fair equivalent for the risk incurred with the *certainty* of meeting its engagements for which the Company's large Capital and Reserves afford an *ample* and *unquestionable* security.

That low rates of Premium are neither *reliable* nor *lasting* is shown by the action of the "Positive" Company *which has recently made a considerable increase* in its rates for this country.

Examples of Rates of Premium.

Annual Premium for whole Term of Life to assure Rs. 1,000 at death. Age 20, Rs. 27, Age 25, Rs. [illegible] Age 30, Rs. 33-12.

Annual Premium payable for ten years only to assure Rs. 1,000 at death. Age 20, Rs. [illegible], Age 25, Rs. [illegible] Age 30, Rs. 63-7-4. If Premium discontinued a free paid up Policy granted for proportionate amount.

Annual Premium for Endowment Assurance of Rs. 1,000 :—

		Payable at 50 or sooner in the event of previous death.				Payable at 55 or sooner in the event of previous death.		
Age next Birth-day. 20	Rs.	38	10	0	... Rs.	31	8	0
25	,,	45	7	4	..	39	6	0
30	,,	58	2	8	... ,,	48	10	8

London Board of Directors.

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Prospectuses, Forms of Proposal, &c., on application to any of the Agents, or to

29, DALHOUSIE-SQUARE,
Calcutta, 1st April 1878.

C. H. OGBOURNE,
Manager in India.

THE

STANDARD LIFE ASSURANCE COMPANY,

ESTABLISHED 1825.

Edinburgh, *Medical Officer.*—SIR R. CHRISTISON, Bart., M.D. | **London.** *Medical Officer.*—SIR JOS. FAYRER, M.D., K.C.S.I.

SPENCER C. THOMSON, *Manager and Actuary.*

Results Communicated in the Report.

Amount proposed for Assurance during the year 1875 (2,167 Proposals)	£1,806,698 8 4
Amount of Assurances accepted during the year 1875 (2,070 Policies) .	£1,509,528 8 1
Annual Premiums on new Policies during the year 1875	£18,564 18 6
Claims by Death during the year 1875, exclusive of Bonus Additions ..	£424,399 16 11
Amount of Assurances accepted during the last five years . .	£6,018,364 4 4
Subsisting Assurances at 15th November 1875, (of which £1,190,339 4s. is Re-assured with other Offices)	£18,383,287 15 1

Revenue, upwards of three quarters of a million pounds per annum.

Assets, upwards of five millions sterling.

NICHOLLS & CO.,

EAST INDIA

FINANCIAL, GENERAL & SHIPPING AGENTS.

LONDON.

1, WHITEFRIARS STREET, FLEET STREET E.C

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8, OLD COURT HOUSE STREET.

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Sums received on fixed deposit subject to notice of withdrawal. Interest allowed at the following rates:—

Repayable at 6 months' notice ...	5 per cent.
" at 12 months' notice " ...	6 "
" at 2 years' notice ..	7 "

Pay Bills, Pensions, and Allowances drawn, Premium on Life Policies paid on due dates, and Bills collected.

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Kept in safe custody. Interest and Dividends realized on due dates, and disposed of as desired. Purchases and Sales effected at the best market rates.

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Sterling Bills negotiated, and remittances made by Bills on our Calcutta House, or by Bank Draft. Special attention paid to family remittances, the first of Exchange, when desired, sent direct to the payee.

Charges.

½ per cent on purchase or sale of Stocks, Shares, Bills, &c. on realisation of interest and dividends, and delivery of Securities out of safe custody.

1 per cent on realisation of Pay Bills, Pensions, &c.

2½ per cent. on General Agency Business.

NICHOLLS & COMPANY,

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A LADY and Gentleman residing near London, are willing to undertake the charge of two or three young children. Every care would be taken, a superior education imparted, and the comforts of a happy Christian home provided.

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6 lines ... ... £ 0 5 0

And 9d. per line for every additional line—Average 11 words to a line.

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WANTED a Situation in the Calcutta Tea Markets or a Plantation by one who has had good experience in London.

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M. P.—9, *Guildford Place,*
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TO INVESTORS.

AN excellent opportunity occurs for securing a Half Share in a well established Tea Estate, situated in a most healthy part of the Neilgherries, and only 30 hours by cart and rail from the nearest sea port. Labour and Fuel are both abundant in the neighbourhood.

The Estate which is upwards of one hundred acres in extent, comprises a large well-built house with stables and offices complete, factories, &c with machinery worked by water power About seventy-two per cent. of the acreage is under tea, more than half of which is in full bearing. There are besides about twenty thousand Gum and some Cinchona trees on the plantation. Prices of Half Share, £2,750 Sterling.

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CLARK'S "WORLD FAMED BLOOD MIXTURE."

TRADE MARK,

"BLOOD MIXTURE."

THE GREAT BLOOD PURIFIER AND RESTORER,

FOR cleansing and clearing the blood from all impurities, cannot be too highly recommended.

For Scrofula, Scurvy, Skin Diseases, and Sores of all kinds it is a never-failing and permanent cure.

It
Cures old Sores.
Cures Ulcerated Sores on the Neck.
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Clears the Blood from all impure Matter, from whatever cause arising.

As this mixture is pleasant to the taste, and warranted free from anything injurious to the most delicate constitution of either sex, the Proprietor solicits sufferers to give it a trial to test its value.

Thousands of Testimonials from all parts.

Sold in Bottles 2s. 6d each, and in cases, containing six times the quantity, 11s. each - sufficient to effect a permanent cure in the great majority of long standing cases, BY ALL CHEMISTS and PATENT MEDICINE VENDORS throughout the world.

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Dry Monopole ...	quarts	Rs.	50	0
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Eugene Cliquot, Reims.

Fine Dry Champagne	quarts	,,	36	0
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Fine Pale Old Brandy	quarts	,,	22
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Stone's Bass' Beer.

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Rs. 26 per dozen quarts.

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Chateau Delorme	1868 Margaux	Rs. 24
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Christine Nillson	,, 40
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Yquem Crémant	,, 30
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Liqueurs Mousseuses (Assorted)	,, 48

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Chateau Dixmerie (* * *)	,, 33
Ditto (*)	,, 27
Ditto (0)	,, 25
Peinlong and Co.	,, 25
Jules Beliot and Co., per Case of 24 Flasks	,, 30
Ditto ,, ,, 48½ ,,	,, 36
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Ancihard & Co.	,, 21
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Courtney and Co.'s well-known Sherry (Dry)	,, [illegible]

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This Wine needs no word of praise from us, and is recognized by all connoisseurs as taking the first rank among Champagne

Rs. [illegible]2 per dozen quarts.
Rs. 55 per 2 dozen pints.

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This Wine is pleasantly dry, clean, and light, it is well spoken of by all who have tried it.

Rs. 45 per dozen quarts.
Rs. 48 per 2 dozen pints.

CHAMPION & CIE.

A pure fruity Wine,

Rs. 36 per dozen quarts.
Rs. 32 per 2 dozen pints.

Sparkling Hocks.

These two Wines are the produce of the choice Vineyards of Rudesheim.

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Dry, with great delicacy and bouquet.

Rs. 15 per dozen quarts.
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A Wine full of flavor and body, recommended.

Rs. 30 per dozen quarts.
Rs. 33 per 2 dozen pints.

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A very choice dry Wine, with full Muscat fragrance

Rs. 45 per dozen quarts.
Rs. 48 per 2 dozen pints.

Sparkling Red Burgundy.

GOLDFOIL.

A pure full-bodied luscious Wine, invaluable to Invalids.

Rs. 42 per dozen quarts,
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ALSO JUST LANDED

FOR THE HOT WEATHER!!

Creaming Devonshire Cider.

Quarts, per dozen	Rs. 7 8
Pints, per dozen	,, 5 8

A delicious refreshing and cooling drink.

G. F. KELLNER & CO.,

WINE MERCHANTS,

Under the Patronage of, and by appointment to,

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GOVERNOR-GENERAL OF INDIA,
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Five per cent. Discount for Cash on above quotations, excepting Pommery, which is net,

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Per case of one dozen.

Castle	I	PORT	Spanish		Rs. 14	0
Castle	IA	PORT		4 years in wood	,, 17	0
Castle	A	PORT		5 years in wood	,, 19	0
Castle	B	PORT		8 years in wood	,, 21	0
Castle	C	PORT	Fruity	11 years in wood	,, 24	0
Castle	E	PORT	Fruity	15 years in wood	,, 28	
Castle	J	PORT	Dry	40 years in wood very light in color	,, 35	0

SHERRY.

Castle	IA	SHERRY	Pale	3 years old	Rs 15	0
Castle	A	SHERRY	Pale	4 years old	,, 17	0
Castle	O	SHERRY	Pale	6 years old	,, 21	0
Castle	G	SHERRY	Pale	8 years old	,, 24	0
Castle	I	SHERRY	Pale	11 years old	,, 2	0
Castle	L	SHERRY	Amontillado	13 years old	,, 31	0
Castle	R	SHERRY	Amontillado	18 years old	,, 35	0
Castle	S	SHERRY	Amontillado	25 years old	,, 40	0
Castle	ONE	SHERRY	Manzanilla	4 years old	,, 18	0
Castle	M	SHERRY	Manzanilla	7 years old	,, 21	0
Castle	N	SHERRY	Manzanilla	7 years old	,, 27	0
Castle	Z	SHERRY	Manzanilla	11 years old	,, 34	0
Quinine		SHERRY			,, 21	0

MARSALA.

Castle	VP	SHERRY	Marsala pale	Rs 15	0
Castle	AA	SHERRY	Marsala gold	,, 16	0
Castle	O	SHERRY	Marsala pale	,, 17	0

CLARET.

Castle	A	CLARET	1 year in bottle	Rs. 12	8
Castle	A	CLARET	pints, 2 dozen	,, 14	8
Castle	C	CLARET	1 year in bottle	,, 16	0
Castle	C	CLARET	pints, 2 dozen	,, 18	0
Castle	D	CLARET	1 year in bottle	,, 20	0
Castle	D	CLARET	pints, 2 dozen	,, 22	0
Castle	G	CLARET	old in bottle	,, 30	0

HUNGARIAN WINES.

Castle	I	RED KARLOWITZ		Rs 17	0
Castle	I	RED KARLOWITZ	2 dozen pints	,, 19	0
Castle	2	RED KARLOWITZ		,, 18	0
Castle	2	RED KARLOWITZ	2 dozen pints	,, 20	0
Castle	8	WHITE HUNGARIAN		,, 18	0

CHAMPAGNE.

Castle	3A	CHAMPAGNE	dry	Rs. 32	0
Castle	3A	CHAMPAGNE	pints, 2 dozen	,, 33	0
Castle	4A	CHAMPAGNE	dry	,, 38	0
Castle	4A	CHAMPAGNE	pints, 2 dozen	,, 39	0
Castle	5A	CHAMPAGNE	very dry	,, 44	0
Castle	5A	CHAMPAGNE	pints, 2 dozen	,, 45	0

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Castle	2	MOSELLE	Sparkling	Rs. 31	0
Castle	3	MOSELLE	Sparkling	,, 36	0

HOCK, BURGUNDY, SAUTERNE.

Sparkling		RED BURGUNDY		Rs. 40	0
Castle	2	BURGUNDY	Red	,, 16	8
Castle	4	BURGUNDY	Red old	,, 27	0
Castle	5	BURGUNDY	Red old	,, 30	0
Castle	B	SAUTERNE		,, 20	0
Castle	B	HOCK		,, 20	0

SPARKLING SAUMUR WINES.

Castle	SILVER FOIL	Sparkling	SAUMUR		Rs. 24	0
Castle	SILVER FOIL	Sparkling	SAUMUR	Pints 2 dozen	,, 25	0
Castle	GOLD FOIL	Sparkling	SAUMUR		,, 27	0
Castle	GOLD FOIL	Sparkling	SAUMUR	Pints 2 dozen	,, 28	0

SPIRITS.

Castle	OF	GIN	Unsweetened 17 under proof	Rs. 18	8
Castle	P[illegible]	GIN	Unsweetened proof	,, 19	8
Castle	UP	GIN	Sweetened 33 under proof	,, 19	0
Castle	UP	GIN	Unsweetened 33 under proof	,, 19	0
Castle	SO	WHISKEY	Scotch proof, very old	,, 23	0
Castle	DO	WHISKEY	Irish proof, very old	,, 23	0
Castle	D	PALE COGNAC	33 under proof	,, 24	0
Castle	E	BRANDY	Cognac pale, 17 under proof	,, 25	0
Castle	F	BRANDY	Cognac pale proof	,, 27	0
Castle	FO	BRANDY	33 under proof	,, 30	0
Castle	FO	BRANDY	Cognac pale proof, very old	,, 33	0
Castle	[illegible]	Extrait du Vin proof		,, 35	0
ORANGE BITTERS				,, 20	0

RUM.

Castle	UV	RUM	17 under proof	Rs. 21	0
Castle		PROOF RUM		,, 22	0

The purity and genuineness of every article is guaranteed, and can be ascertained by analysis in accordance with the Act (Adulteration Act) 35 and 36 Vic., Cap. 74

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BEER! really good BEER!

Is recommended as being

THE BEST, MOST WHOLESOME AND DELICIOUS BEER

Procurable in the market, *viz :—*

BASS'S BEER

BOTTLED BY

MESSRS. E. JOHNSON & CO.

AS GOOD AS

Bass's Beer Bottled by Stone.

Price per dozen Rs. 4-12 *quarts, and Rs.* 2-12 *pints.*

G. C. SHAW & BROTHERS have much pleasure in announcing that the above Beer, after its first introduction by them to the Calcutta public, not many weeks ago, has met with steadily increasing demand, and promises one day, at no distant period, to gain for Johnson & Co. as great a popularity as that of Stone; and, by virtue of its unprecedentedly cheap price, to become even a greater favorite among the lovers of good Beer in these days of wise economy.

Our Stock consists of fresh arrivals just fit for use, and we promise that every one will find a very good means of successfully grappling with the present trying weather by giving Messrs. Johnson's Beer an early trial—thanks to Messrs. Tudor & Co. also.

BASS'S INDIAN PALE ALE.

Quarts, Rs. 5 per dozen.

Bottled by Messrs William, Edmonds & Co.

Kinahan's L.L. Whisky,

Rs. 24 per dozen.

The Cream of Old Irish Whisky, Pure, Mild, and Mellow.

McDonald's Dew of Ben Nevis Scotch Whisky.

Rs. 24 per dozen.

Matured in Sherry Casks and guaranteed pure Malt Whisky

Gathmann's Caracas Bitters.

A very pleasant Tonic, and very useful in all affections arising from weakness or relaxation of the digestive organs.

Per bottle, Re. 1-8.

Cash on delivery from our Godowns.

ROBERTSON, BOWYEAR & CO,
35, Clive-street,

Goods not approved can be returned.

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THE

CALCUTTA MUSICAL ESTABLISHMENT.

No. 13/1, Government Place, East.

(LATE BURKINYOUNG & CO.)

FOUNDED, A D. 1811.

PROPRIETOR—CHARLES GOULD.

THE SMITH AMERICAN ORGAN,

Wholly new designs and effective combinations in Reed Organs.

THE American Organ has been and still is the most popular and valued instrument for Churches and Chapels. Immense number of them are used in public worship, and it has been found that no other reed Organs have so much sustaining power joined with such melodious quality of tone.

Style No. 10, *Seven Stops.*

This Style is furnished with two complete sets of reeds of five Octave. Each set is divided and has a separate stop, for the upper and lower half. The upper half of the first set of reeds is named Flute, and the lower half Principal. In the second set the upper half is named Dulciana, and the lower Diapason. The first set is an Octave higher in pitch than the second, so that the instrument has practically a compass of six Octaves. By having the sets divided, it will be seen that more effect can be produced. The remaining stops are Tremelo Diapason Forte, and Principal Forte. [*Net Cash, Rs.* 400.

Style No. 16, *Ten Stops.*

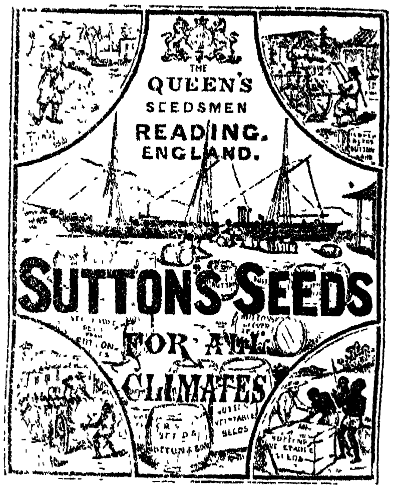
This instrument has two and a half sets of reeds, and an Octave of Sub-bass. It has ten stops, *viz.*, Diapason, Dulciana, Flute, Principal, Kulophon, Sub-bass, Tremelo, Principal Forte, Diapason Forte, and Octave Coupler. The last stop doubles the power of the Organ, and with the aid of the Sub-bass renders it a powerful and effective instrument for Churches and Halls; at the same time its power is not obtained at any sacrifice of delicacy, and it will be found a most desirable instrument for home use. [*Net Cash, Rs.* 650.

Style No. 20, *Nine Stops.*

This instrument has three complete sets of reeds. Two of the sets are like those in the preceding Styles, having the Principal and Forte Diapason and Dulciana stops. The third set is new and distinct in quality, the upper half is named "Aulodia" and the lower half "Fagotte." The tones of this set are unrivalled in clearness, smoothness and tender beauty, and their effects in connection with the swell are surprising.

This Organ is one that will be approved by all persons of refined taste. [*Net Cash, Rs.* 750.

N.B.—**The above prices are exclusive of packing charges.**



SUTTON'S COMPLETE COLLECTIONS,

VEGETABLE SEEDS.

No. 1	Collection	...	£10	10	0
No. 2	,,	...	5	5	0
No. 3	,,	...	4	4	0
No. 4	,,	...	3	3	0
No. 5	,,		2	2	0
No. 6	,,	...	1	1	0
No. 7	,,	..	0	12	6

FLOWER SEEDS.

No. 1	Collection	...	£2	2	
No. 2	,,	...	1	11	0
No. 3	,,	...	1	1	6
No. 4	,,	..	0	10	0
No. 5	,,	...	0	5	0

Including only sorts suitable to the climate, and packed by an improved system, which ensures their arrival in fresh and good condition.

From Mr. J. M. HENRY, Superintendent, Agri-Horti. Society's Gardens, Madras.

JULY 3 —" We received the seeds and other things in excellent order. We have tried them all, and find them of first-class quality, not one seed failing to germinate, and this being our very hot season, everything was against them."

ALSO

LUCERNE, GRASS AND CLOVER SEEDS,

AND ALL

AGRICULTURAL SEEDS

Of the best quality.

☞ A REMITTANCE MUST ACCOMPANY EACH ORDER.

SUTTON'S INDIAN GARDENING GUIDE

MAY BE HAD

GRATIS AT THE OFFICE OF THIS PAPER;

OF

MESSRS THACKER, SPINK & CO. CALCUTTA,

MESSRS THACKER & CO, BOMBAY;

(by sending One Anna for Postage.)

or Post Free on application to

Sutton & Sons

THE QUEEN'S SEEDSMEN,

READING and LONDON, ENGLAND.

SEEDS OF PRIZE FLOWERS.

CATALOGUE OF SEEDS.

With every Article Priced, on application.

[*All half natural Size*]

MR. WILLIAM BULL'S
SEEDS OF PRIZE FLOWERS.

	PER PACKET.	
Prize ASTERS. Collection of assorted colours	2s	6d.
Prize BEGONIAS. Handsome flowered section, mixed colours	2	6
Prize COCKSCOMB	1	0
Prize CALCEOLARIA. Various colours, mixed	2	6
Prize CINERARIA. Various colours, mixed	2	6
Prize CYCLAMEN PERSICUM. Various colours, mixed	2	6
Prize GLOXINIA. Various colours, mixed ,	2	6
Prize PANSY	2	6
Prize PELARGONIUM	2	6
Prize PETUNIA. Choice hybridised, various colours, mixed . . .	1	6
Prize PRIMULA SINENSIS FIMBRIATA. Red	2	6
Prize PRIMULLA SINENSIS FIMBRIATA. White	2	6
Prize PRIMULA SINENSIS "BULL'S PREMIER" Mixed colours	2	6
Prize STOCKS. Collection of assorted colours .	2	6
Prize ZINNIA, double-flowering. Collection of assorted colours	2	6

FOR THE BEST SEEDS FROM PRIZE STRAINS OF ALL FLOWERS

APPLY AT MR. WILLIAM BULLS ESTABLISHMENT.

EXTRACTS FROM LETTERS OF CORRESPONDENTS.—

"I took all the first prizes at our late Show, with Pelargoniums raised from your seed."

"The flowers from your seeds are splendid."

"We expected your seeds to produce something extra, and it is but fair to say they have exceeded our expectations."

"My Chinese Primulas from your seed are the admiration of everybody."

"You may expect large orders from our colony, for your seeds have proved excellent, and I have shown the plants I have raised to all my friends. The flowers of some are magnificent."

"From a packet of your Petunia seed I have raised some splendid new varieties, which I am going to dispose of to our local nurserymen."

VEGETABLE SEEDS of all sorts. Vide Mr. William Bull's Catalogue, in which every article is priced.

NO ORDINARY MIXTURES,

Or OLD SEEDS are supplied

VEGETABLE SEEDS and FLOWER SEEDS

For LARGE or SMALL GARDENS

The GERMINATING POWER of all SEEDS is proved before being sent out,

AGRICULTURAL SEEDS of all sorts

PRICES of which are detailed

In Mr. WILLIAM BULL'S SEED CATALOGUE.

FOREIGN ORDERS.—PLANTS, Seeds or Bulbs for transmission abroad selected and packed with the greatest possible care in Mr. WILLIAM BULL'S patent plant cases or close boxes, according to the nature of the goods, and despatched by the best route, per steamers, clipper ships, and railways, to any part of the world.

A REMITTANCE, by cheque, Post-office order, or stamps, must accompany all orders from unknown correspondents.

MR. WILLIAM BULL,

ESTABLISHMENT FOR SEEDS & NEW PLANTS,
KING'S ROAD, CHELSEA, LONDON, S.W.

THE

NEW LIBERIAN COFFEE.

"COFFEA LIBERICA."

THIS NEW PLANT is now attracting considerable attention in all Coffee-growing countries. Its many desirable characteristics are making it anxiously sought after, notwithstanding the firm hold so long established in popular estimation and on the market, in favour of the ordinary *Coffea Arabica*, in the New as well as the Old World.

Liberia, being a comparatively unknown region of Western Tropical Africa, has allowed this finer, more robust, and prolific species of Coffee to remain practically unknown to the marts of the world. The attention of merchants and commercial men has, however, been drawn to it, and a wonderfully important change, amounting to almost a revolution in this trade, is apparently about to be effected.

From all that is known of this new product up to the present time, it is anticipated that it will prove one of the most useful and remarkable additions to the commerce of the century.

During the last five years Mr. William Bull has been making this Coffee known, and shipping plants of it to various Coffee-growing countries, and its many excellent qualities having become known and appreciated, planters have intimated that if Mr. WILLIAM BULL could succeed in getting quantities, and offer plants at a lower rate than hitherto, thousands would be planted where only hundreds have previously been tried. In consequence, Mr WILLIAM BULL sent a collector to Liberia, and obtained, at some considerable expense, a large quantity of seed, which, however, failed to grow; and the general experience is that raising plants of this Coffee from seed is very precarious. Large sums have been fruitlessly spent for the purpose in Ceylon, and other places. Not being able to guarantee the growth of the seeds, Mr W. B. turned his attention to plants, and sent to his collector in Liberia a number of his Patent Cases to bring this Coffee home, with the result that he has now a large stock of plants, well-rooted and established in boxes and pots, having been growing in his Establishment during the past year.

To successfully export plants of this Coffee they should have made a season's growth in this country, experience has proved that plants coming from Liberia should be grown and thoroughly established for something like twelve months before being sent abroad.

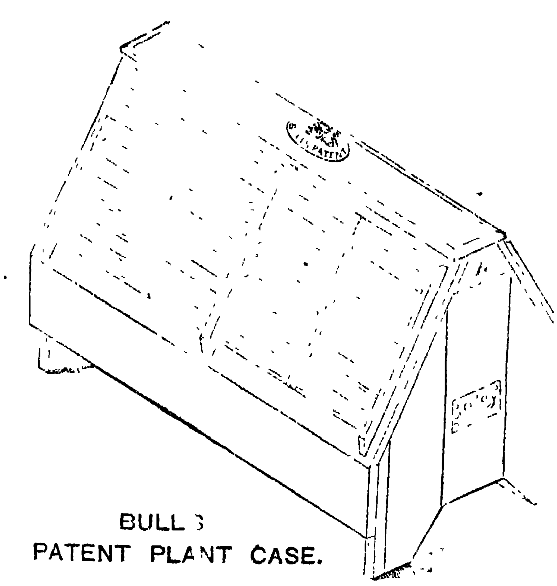
The prices at which Mr WILLIAM BULL is now prepared to supply this Coffee are as follows:—

1,000 plants ...	.	...	at	4s.	0d.	each
500 ,,	...	...	.. ,,	4s	6d	,,
100 ,,	...	...	. ,,	5s	6d.	,,
50 ,,	.	...	. ,	7s.	6d.	,,
30 ,,	...	...	,,	10s	6d.	,,

The Plants can be safely sent abroad in Mr WILLIAM BULL'S PATENT PLANT CASES; Plants being specially prepared for that purpose in

MR. WILLIAM BULL'S NEW PLANT ESTABLISHMENT,

KING'S ROAD CHELSEA, LONDON.



BULL'S
PATENT PLANT CASE.

The prolific character of the Liberian Coffee is remarkable in comparison with *Coffea Arabica*. A well known Coffee planter went especially to Liberia to judge for himself of the commercial importance of this new product, and in a letter to the *Ceylon Observer* he writes as follows:—

"An estate of 20 or 30 acres well looked after would yield as much Coffee as one with 200 or 300 acres of *Coffea Arabica* or Ceylon. Coffee berries are like plums, as big. The unpruned Coffee has no leaf disease."

Merely being prolific, however, would not establish the reputation for this Coffee in the markets of the world which it will surely command. It will be due in a great measure to its flavour, so that for some years to come it may be expected to realise, weight for weight, two or three times the price of the best qualities of *Coffea Arabica*.

Papers relating to the cultivation of Liberian Coffee have lately been laid on the table of the Legislative Council of Ceylon, and they contain the most satisfactory reports imaginable on this new product, made up from information gathered in Liberia. One great advantage of the Liberian Coffee is that it grows and yields its prolific crops equally well in the immediate neighbourhood of the sea, and at considerable distances from it, so that whole tracts of land will, in various countries, now become valuable for Coffee growing which have hitherto been unsuitable for the purpose, as *Coffea Arabica* cannot be cultivated to produce a paying crop except at a certain elevation.

WILLIAM BULL, F.L.S.,

ESTABLISHMENT FOR NEW AND RARE PLANTS AND SEEDS,

KING'S ROAD, CHELSEA, LONDON.

WILSON, MACKENZIE & CO.,

13, OLD COURT HOUSE-STREET, AND 1, MANGOE-LANE.
(Opposite the New Telegraph Office and
the Currency Department)

Importers of every description of Oilman's Stores, Cigars Tobacco, and Miscellaneous Goods :—

Fresh Invoices

Per S.S. *Pocnah* of new American preserves, including

Lunch Tongue		Re. 1	4	per tin.
Devilled Ham		„ 0	12	„
„ Turkey		„ 0	12	„
„ Game		„ 0	12	„
Spiced Salmon	(a great delicacy)	„ 2	8	„
String Beans	superior to French	„ 0	12	„
Green Peas	„ „	„ 0	14	„
American Ox Tongue, large		„ 4	0	„
„ „ small		„ 3	0	„
Canadian Hams in small sizes		„ 0	11	per lb.

Whitehead's Solidified Soup Squares.

Each square containing the concentrated essence of 1½ lb Beef, free from fat or bone, with sufficient vegetables and flavouring ingredients to make 1½ pts of strong nutritious Soup, most convenient for travelling.

Assorted kinds per single square As. 10, or per box of 12 squares Rs. 7.

PRIME BACON IN CUT, AT RE 1 PER lb.

OVERLAND CHEESE, RE. 1-2 PER lb.

Miscellaneous Articles.

Scriptural Text Cards, Toy Books, Albums, and Stationery of all kinds, Walking Sticks, Courier Bags, Gladstone Travelling Bags, Japanned Tin Cheroot Boxes, Dispatch Boxes, Travelling Trunks, Portmanteaux, Hand Bags, Rug Straps, Hat Boxes, Railway Rug, Scotch Mauds, Ceba Down Quilts, Elder Down Tea Cosies,

ALL MARKED AT EXCEPTIONALLY LOW RATES AND THE QUALITY GUARANTEED.

Terms—Strictly Cash.

CHUNDER AND BROTHERS,

STATIONERS AND GENERAL DEALERS.

Nos. 112 *and* 114, *Radha-Bazar,*
CALCUTTA.

EX. S.S "DORUNDA."

Perfumery.

ROWLAND'S "KALYDOR," for improving and beautifying the COMPLEXION, eradicates all cutaneous eruptions and renders the SKIN soft, fair and blooming. Cash Rs. 3 per bottle.

ROWLAND'S "ODONTO," for cleansing, preserving, and beautifying the TEATH and GUMS. Cash, Re. 1-12 per bottle.

ROWLAND'S MACASSAR OIL, for the growth of the HAIR. Cash, Rs. 2 per bottle.

PRICE AND CO'S GOLDEN OIL, for beautifying the HAIR. Cash, Rs. 2-4 per bottle.

WINDSOR SOAP at As 12 per dozen cakes.

Qualities of the abovementioned Perfumery are GUARANTEED

SOAP BOX for one full cake, made of Britannia Metal, Large, Rs. 1 4, middle Re. 1, and small As 14 cash.

GUM RINGS, bone, for teething. Large As. 3, small As. 2, cash.

FLOWER POT COVER, expanding for Drawing-rooms, made of wood of different colours. Large As. 8, middle As. 6, and small As. 4, cash.

SCENT CASE, in roan-covered box, fitted with lock and key, with two cut-glass Bottles, Rs 6, and 3 bottles at Rs 7.

SCENT BOTTLES, Cut glass, white and coloured. Single As 12, double, Re 1-8 cash.

PHOTOGRAPHIC ALBUMS. 4th size, expensively bound in best recent style of building, four different patterns, one pattern fitted with lock and key. From Rs. 30 to Rs 45 each, cash

PHOTOGRAPHIC ALBUMS, oblong shape, tastefully bound, one photograph under glass on the top. From Rs 4 to Rs. 5 cash.

An assortment of other qualities in stock as well

EGG TIMERS A large assortment of fancy and carved. From As 6 to Re 1-8 cash, each.

CHAMPION NUT-CRACKER, very useful for household purpose As. 10 cash.

DITTO HILBORN, at Re. 1 each.

SPORTMAN'S KNIVES with seven blades for seven different purposes. Indispensably necessary for sporting men, at Rs 2-4 cash.

NAIL SCISSORS, at As. 10 each

PEN MAKING MACHINE. Rodgers' Ebony handle, 1st quality, Rs. 5; 2nd quality, Rs. 4 each, cash.

A large assortment of Rodgers' Office Cutleries in stock as well.

C. and Bros. beg to inform the public that by the same steamer they have received a large quantity of Saunders' Hand-made and Machine-made large Writing Paper, De La Rue's, Price's, and Goodall and Son's various sorts of Note Paper and Envelopes.

CHUNDER AND BROTHERS,
112 & 114, RADHA BAZAAR, CALCUTTA.

HARDWARE, &c.

A WROUGHT-IRON BOILER.

11 feet 6 inches by 4 feet 6 inches.

AS good as new, only recently supplied by MESSRS BURN & Co., and has hardly ever been used. Also a Donkey Pump, complete with petcock. A new cast iron 2 inch Safety Valve, complete, and sundry new taps and piping, 1 Drum 18 inches diameter 11 inches broad. Apply to

HOARE, MILLER & CO.

TRANSPLANTING.

Will be ready shortly and Prospectuses will be circulated.

PATENT, SWIFT, & SURE.

Transplanting Tools.

SOME advantages of these tools are the security that with very ordinary care no injury can be done to plants and roots. The swiftness, simplicity, and cheapness of working. The growth of the plant is not at all arrested in transplanting, it grows on as if it had not been shifted. Transplanting can be done at all times with little regard to weather. No vacancies or weakly trees from injured roots. The greatest care has been taken to strengthen all working parts. Specially devised to be put into the hands of "the coolie."

The proprietor of the garden where the transplanter and transporter had a thorough trial (only 30,000 seedlings were put out by three instruments, as more than half of the usual planting time had passed before these three in all parts finished instruments were procured) a tea planter of some twelve years standing writes incidentally to an acquaintance, the transplanter, &c., "is used in this garden with the most wonderful success, and now that I see "the machine in daily work I do not know how this or any other garden "would get on without," and has promised a further testimonial.

CALCUTTA METAL MART.

We quote the following rates for Machinery, &c., in our stock :—

6 H. P. Portable Engine by Clayton & Shuttleworth	Rs.	2,500	0	0
8 H. P. ditto ditto	„	3,250	0	0
10 H. P. ditto ditto	„	3,900	0	0
12 H. P. ditto ditto	„	4,500	0	0

8 H. P. and upward are fitted with reversing Link Motions, Injectors and Spar Pulley.

6 H.P. Tangye's Stationary Engine with vertical Boiler	„	1,500	0	0
12 inches Centrifugal pump with Pipes and valves	„	1,400	0	0
10 „ ditto ditto	„	1,300	0	0
8 „ ditto ditto	„	900	0	0
7 „ ditto ditto	„	800	0	0
6 „ ditto ditto	„	600	0	0
5 „ ditto ditto	„	500	0	0
4 „ ditto ditto	„	350	0	0
"Special" Steam Pump 1	„	250	0	0
Woodford's Pump No. 2 with pipes for 30 feet	„	1,050	0	0
5 inch Double Barrelled Irrigating Pumps	„	100	0	0

Galvanized Barge Pumps	5 in. 55/	6 in. 65/	
Burgess and Key's Water Lift	No. 1 700/	No. 2 900/	
Gresham's Giffard Injectors	No. 4 70/	No. 5 85/	No. 6 100/
Blake's Stone breaker on wheels 15″ × 7		Rs. 2,600 0 0	
Norton and Hawkesley's Disintegrators		No. 1 300/	No. 2 900/
Carr's Patent Disintegrator No. 3		Rs. 2,600 0 0	
Howard's "D" Ploughs		„ 36 each.	
Corn Crushers	No. 1 70/	No. 2 90/	
Chaff Cutters	No. 1 35	No. 3 65/	
Clayton's Brick Presses	No. 1 200/	No. 2 300/	
Screw Cutting Lathes	7 in. 700/	8 in. 900/	
Bench Drills	No. 1 250	No. 2 275/	

Soorkie Mill 6 ft. pan	Rs.	850	0	0
Planing Machine 4′ × 2′ × 2′	„	1,300	0	0
3-ton Portable Steam Crane	„	4,250	0	0

Fencing Wire and Netting, Oils and Paints, Portland Cement and Asphalte, Metals of all kinds, Engineers', Carpenters', and Planters' Tools and Stores of all kinds.

Illustrated priced Catalogue on application.

MACKINNON MACKENZIE & CO.

Established Half a Century.

R. B. RODDA & CO.,

GUN-MAKERS & ARMOURERS,

BY APPOINTMENT
TO HIS EXCELLENCY THE RIGHT HONORABLE
EDWARD ROBERT LYTTON,
Bulwer Lytton, Baron Lytton of Knobworth,
C.M.S.I.,
VICEROY AND GOVERNOR-GENERAL OF INDIA.
AND GUN-MAKERS TO
HIS ROYAL HIGHNESS THE DUKE OF EDINBURGH, K G, &c.,
HIS EXCELLENCY SIR RICHARD TEMPLE, BART, K C.S.I
GOVERNOR OF BOMBAY,
His Honor the Honorable Ashley Eden, C S.I, C S., Lieutenant-Governor of Bengal,
AND
His Excellency General Sir Frederick Paul Haines, G.C B.,
Commander-in-Chief in India

OUR

GUNS, RIFLES, REVOLVERS, AND PISTOLS

Are manufactured at our London Workshops, and thoroughly tested in every stage of progress

SWORDS,

Suitable for all branches of the Services, procured from the best Makers. HUNTING KNIVES and HOG SPEAR HEADS of every well-known pattern in Stock.

We import from the best houses every description of Shooting and Sporting Accessories and Appliances,

CARTRIDGES, CARTRIDGE CASES, WADDINGS, GUN AND RIFLE POWDER, CAPS, CHILLED AND SOFT SHOT, FISHING TACKLE, CRICKETING GEAR, FENCING IMPLEMENTS, BOXING GLOVES, DUMB BELLS, QUOITS, LAWN TENNIS SETS, BADMINTON SETS, RACQUETTE BATS AND BALLS, &c, &c

Illustrated Price List sent on application, with extracts from letters regarding Guns, Rifles, and Revolvers sold during last season.

NO. 7, DALHOUSIE-SQUARE, CALCUTTA.
Near the Scotch Kirk.

N.B —We do not convert Muzzle-loading Guns and Rifles into Breech-loaders *here*, as there is no proof-house in Calcutta wherein they can be tested after conversion as required by Law. This work, however, we undertake, but it has to be executed in London, and undergo the usual proof.

A. BRECK & CO.,

LATE ASSISTANTS, ORIENTAL GAS CO.,
GAS AND WATER CONTRACTORS AND ENGINEERS,
73, WELLESLEY-STREET.

AS we have served our apprenticeship to the above in Scotland we feel assured that we will give entire satisfaction as regards moderate charges and superior workmanship.

Estimates, Plans, and Prospectuses for Oil, Oil-seed, and Coal Gas Works furnished on application.

FOR SALE.

Portable Engines, 8 and 10 Horse Power.
Vertical Engines, 4 Horse Power.
Horizontal Engines, 4 and 6 Horse Power, with and without Boiler and fittings.
Centrifugal Pumps, 7 and 9 inch.
Flour Mills, 3½ and 4 feet.
Weston's Pulley Blocks, 1 to 4 tons.
Circular Saw Bench with 42-inch Saw.

SCOTT & CO,
5, Bankshall-street.

ENGINEERS' MACHINE TOOLS.

Largest Stock in England.

LATHES, Drills, Planing, Shaping, Slotting, Screwing, Punching, & Shearing Machines, Engines, Steam Hammers, &c, of every description. Design and finish are unsurpassed, lowest prices.

SCOTT BROTHERS,
Halifax, England.

FOR SALE.

GALVANIZED Corrugated Iron Sheets, 6 inch, 7 inch, and 8 inch by 18 to 26 gauge.
Galvanized Riding Rivets and Washers.
Do Screws, Nails, Bolts, and Nuts.
One Galvanized Corrugated Iron Roofing Shed, all complete.
Zinc Sheets.
Johnson's Tea Lead.
White Brothers' Portland Cement.
Harrison's Asphalte.
Ramsay's Fire Bricks.

All descriptions of Hardware.

SHIBCHUNDER MULLICK,
78, Clive street.

JEBENS' PATENT

Swift and Sure Transplanting Tools.

PROSPECTUSES NOW READY AND MAY BE HAD ON APPLICATION TO THE MANUFACTURERS.

T. E. THOMSON & CO.,

9, ESPLANADE ROW, CALCUTTA.

SOME of the advantages of these tools are the security, that with very ordinary care, no injury can be done to plants and roots, and the swiftness, simplicity and cheapness of working. The growth of the plant is not at all arrested in transplanting; it grows as if it had not been shifted. Transplanting can be done at all times with little regard to weather. No vacancies or weakly trees from injured root The greatest care has been taken to strengthen all working parts. Specially devised to be put into the hands of the coolie.

Mr. J. W. Mountjoy of Pandawbrang, Arracan, writes as follows regarding these tools:

"The Transplanter has in working proved to be a complete success. Almost all the remaining seedlings have been transplanted by the aid of your instrument, without the slightest injury to their roots or check to their growth. The fact is, the young plants do not know that they have been transplanted, and now that sunshine has succeeded the late very heavy rains, new and vigorous growth is "bursting out" from all the seedlings that were transplanted by means of your Transplanter. No Manager of a Tea or Coffee plantation, who had once seen this instrument at work, would ever again be likely to recur to transplanting by hand, and not a single seedling should die when removed from the nursery and carried to its place of ultimate growth by means of your Transporter. Your Transplanting Apparatus is better than baskets, and has moreover the great recommendation of being very economical. Your Transplanter will, with moderate care, last for many years and combines thorough economy with thorough efficiency."

ORDERS are now being booked and will be executed in succession as received by the Manufacturers and Agents to the Patentee, T. E. THOMSON & CO, 9, ESPLANADE ROW, CALCUTTA, to whom orders should be sent accompanied by CASH or Draft on Calcutta Agent.

Nursery Transplanters complete with one Transporter ...	**NET CASH**	**Rs. 16**
Extra Transporters (1st quality) each	**"**	**Re. 1**

The Transplanters are all marked on the cylinder.

PATENT
C. A. JEBENS.
SWIFT AND SURE.

THE ORIGINAL HARDWARE ESTABLISHMENT OF INDIA.

T. E. THOMSON & CO.,

9, ESPLANADE-ROW,

CALCUTTA.

IMPORTERS OF

ALL KINDS OF MACHINERY
AND
AGRICULTURAL IMPLEMENTS.

HAVE ALWAYS IN STOCK

Portable Steam Engines, 6, 8, 10, 12, H.P.
Patent Centrifugal Appold Pumps.
Steam Ploughs, Horse Ploughs, Harrows, and Horse Hoes.
Thrashing and Dressing Machines.
Patent Corn Screens.
Cotton Gins.
Rice-shelling Machines.
Chaff-cutting Machines.
Corn Crushers with Fluted Rollers.
Corn and Seed Crushers, with smooth Rollers for crushing Oats, Linseed, Malt, Barley, &c., and for kibbling Beans, Maize, &c.
Patent Root-graters or Turnip-cutters.
Flour Mills for Hand, Cattle or Steam Power.
Flour-dressing Machines.
Patent Root Washers.
,, Corn Separators.
,, Aspirators.
,, American Grist Mills.
Driving Gear for Horses or Bullocks.
Chain Pumps.
Well Engines.
Hand Lift and Force Pumps.
Garden Engines and Syringes.
Water Barrows.
Lawn Mowers.
Watering Carts.
Brick, Tile, and Pipe Machines.
Improved Brick-pressing Machines.
Sodawater and Bottling Machines.

Full Particulars with Prices on application.

MANUFACTURERS OF AND AGENTS FOR SALE OF
JEBEN'S PATENT SWIFT AND SURE TRANSPLANTING TOOLS;
ALSO AGENTS IN
NOTHERN INDIA, BURMAH, AND SIAM FOR SALE OF PLIMPTON'S PATENT ROLLER SKATES.
Full particulars, with Prices, on application.

PHŒNIX FOUNDRY,

CALCUTTA.

THE OLDEST ENGINEERING ESTABLISHMENT IN INDIA.

JESSOP & CO.,

Civil and Mechanical Engineers, Contractors, Brass and Iron Founders, Metal Merchants, &c.

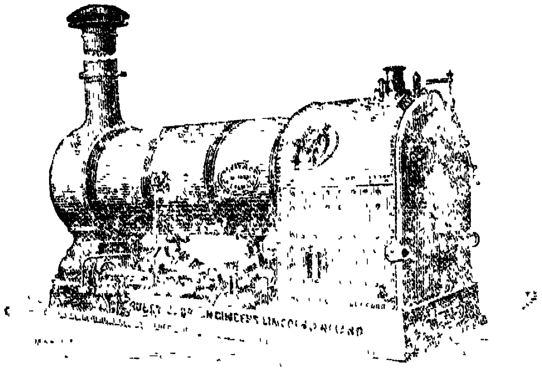
Forged and Cast Iron Work, Boilers, Machinery for Jute, Cotton and Rice Mills, Collieries, Indigo Concerns, Tea Gardens, &c., Contractors and Brick-making Plant, and every class of Iron and Brass Work made to order.

SOLE AGENTS FOR

Robey & Co.'s celebrated Portable and Fixed Engines and Machinery, Gwynne & Co.'s Centrifugal Pumps, Gould's Rotary Pumps, and Robinson's Patent Steam Traps.

Importers and Manufacturers of every description of Steam Engines and Machinery.

Portable Engines, 6, 8, 10, and 12 H.P., by Robey & Co., with enlarged Fire Boxes for burning Wood or Coal, Steam-jacketted Cylinders, and all the latest improvements.



The Patent "Robey" Fixed Engine.

This Engine, for simplicity of design, ease of erection, and economy in first cost and subsequent working is unapproached by any other. Very slight foundations are required, while the brick chimney, boiler flues, and casing of the ordinary Horizontal Engine with separate Cornish Boiler are altogether saved. There is also a great saving in the cost of transit, which, in the case of the Horizontal Engine and Boiler, is very great, owing to the cumbersomeness of the Boiler. The economy in fuel, as proved by actual working, is from 30 to 50 per cent., when compared with the old type of Engine doing the same work.

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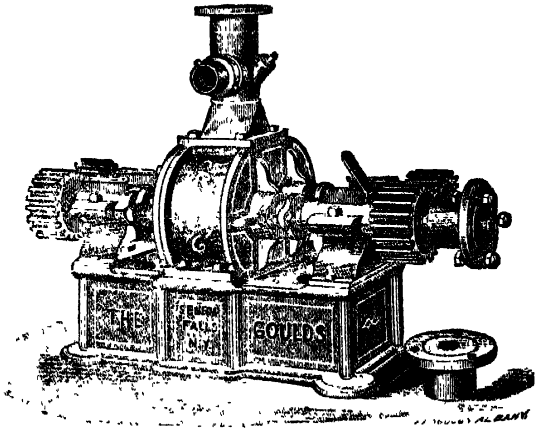
Lift and Force Pumps in great variety, suitable for Gardens, Dwelling Houses, or Irrigation.



Rotary Pump, for Bullock or Steam Power.

Rotary Power Pump No. 4 has a 5-inch Suction and 4-inch Delivery Pipe, and with 150 revolutions discharges 250 Gallons per minute.

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Hand Rotary Pumps, to discharge 800, 900, 1,500 and 1,800 Gallons per hour.

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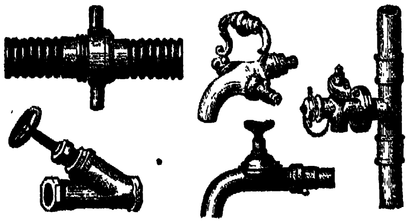

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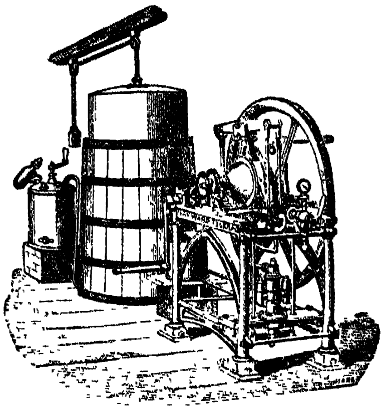

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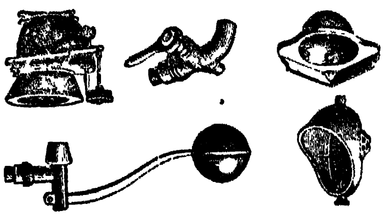

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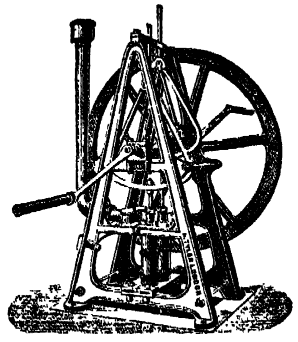

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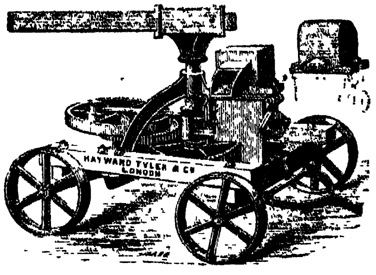

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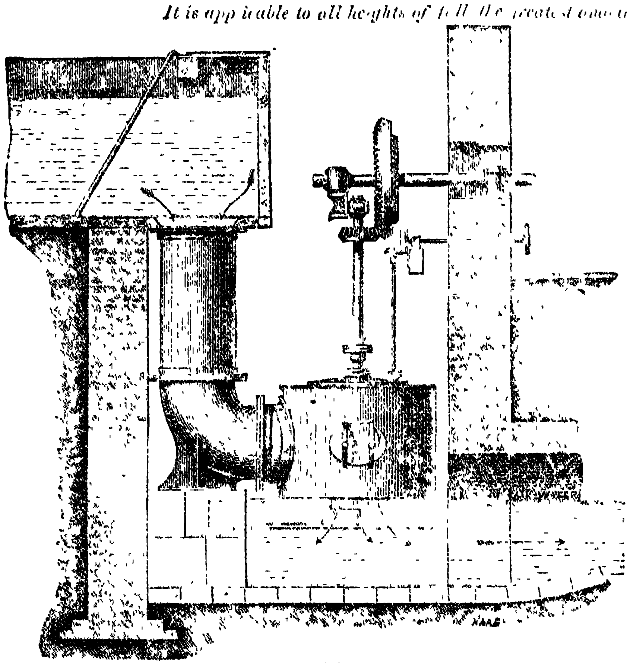
IMPROVED & ECONOMICAL APPLICATION OF WATER POWER.

LEFFEL'S IMPROVED PATENT DOUBLE TURBINE WATER WHEEL.

It is applicable to all heights of fall, the greatest amount of power, with the least consumption of water.



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A few of its advantages are—on high falls the cost is very much less than that of an ordinary water wheel, also gives a greater percentage of power. On low falls, this Turbine possesses the valuable property of not being affected by floods or backwater. It is applicable with advantage to falls where the quantity of water is very *variable*, always giving out power in proportion to the water used. The gates of this wheel can be altered while the wheel is running, simply by turning the starting hand wheel, to regulate power, and utilize the available supply of water. The gearing and connections are light. Foundations are few and inexpensive. Light shafting can be used. It works steadier than a common water wheel. It can be easily coupled to a steam engine. It is not liable to damage by drift, or to be choked by leaves. It occupies very little space. Power can be carried long distances by means of Wire Ropes, across chasms, over tops of houses, also to summits of mountains. (By these means it is invaluable to Manufacturers, Miners, and others.) Speed is attained at once, without multiplicity of gearing. This wheel will give at the least 80 per cent. of efficiency. Over 7,000 wheels in use. It is adapted for driving all kinds of Mills and Machinery.

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BLAKE'S PATENT DIRECT-ACTING STEAM-PUMP, MORE THAN 10,000 IN USE.

The following are some of the prominent advantages of the Blake Pump :—

It will start at any point of stroke.

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It works fast or slow, with the same certainty of action.

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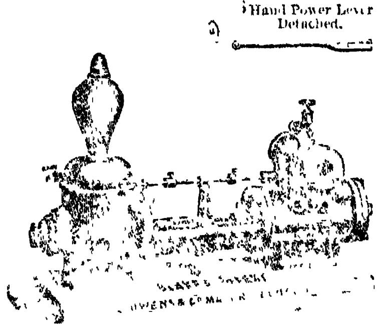
It is interchangeable in all its working parts.

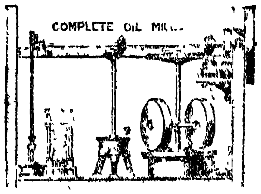
It will deliver more water than any other Pump.

It is made of best materials in the most workmanlike manner.

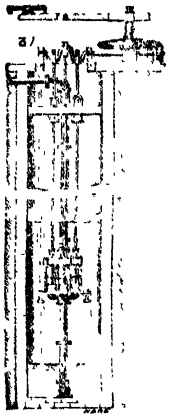
Can be worked at 20 strokes per hour, or 200 strokes per minute.



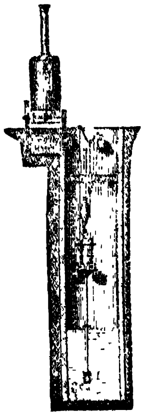
BLAKE'S PATENT
Direct Acting Steam Pump [illegible] Feeder



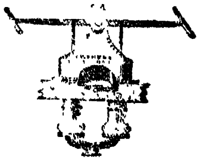
Oil Mills, for Steam or Cattle Power



Deep-well Pumps, for Horse or Bullock power.

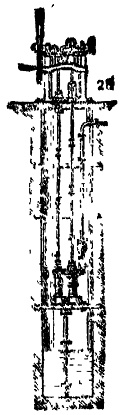


Vertical Combined Steam Engine, Boiler, and Deep-well Pumps,

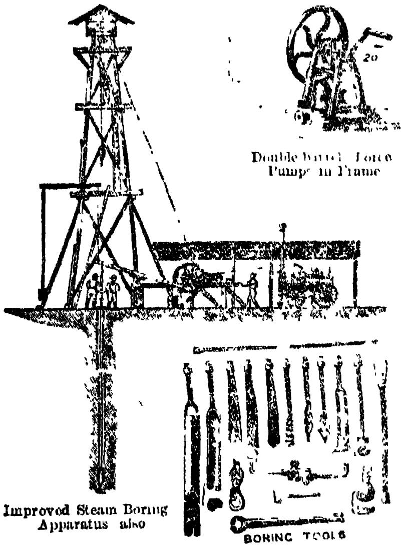


Double-barrel Contractors' Pumps, for hand or steam power.

Double-barrel Fire Engine, for Mansions, Factories, &c.



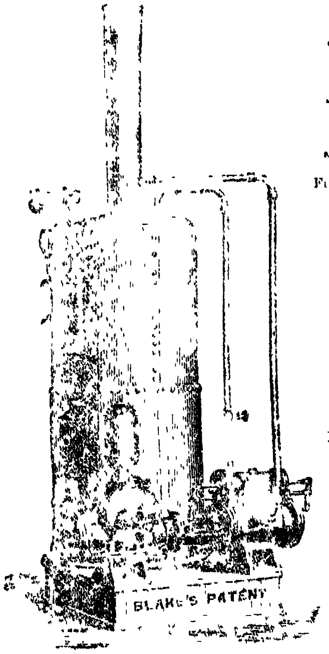
Deep Well Pump for Hand power

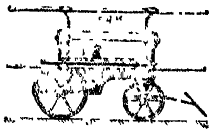


Double-barrel Force Pumps in Frame

Improved Steam Boring Apparatus also

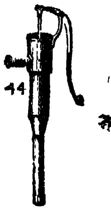
Boring Tools of every description, for Artesian Wells, testing for Minerals, Foundations, &c.



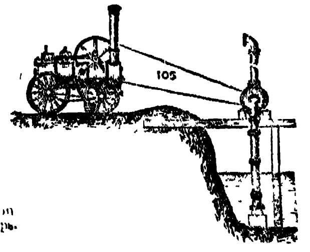


Fire Engines, for Towns, Railway Stations, &c

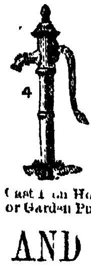
Force Pumps on Barrow,



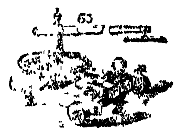
Wrought Iron Portable Pumps.



Patent Centrifugal Pumps, for Contractors' use, or Irrigation work.



Cast Iron House or Garden Pump.



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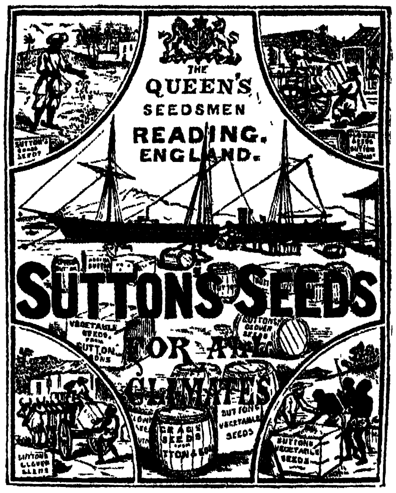

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6 H. P Portable Engine by Clayton & Shuttleworth	Rs. 2,500	0	0
8 H. P. ditto ditto	„ 3,250	0	0
10 H P. ditto ditto	„ 3,900	0	0
12 H P. ditto ditto	„ 4,000	0	0

8 H. P. and upwards are fitted with reversing Link Motions, Injectors and spare Pulley.

6 H.P Tangye's Stationary Engine with vertical Boiler	„ 1,900	0	0
12 inches Centrifugal pump with Pipes and valves ..	„ 1,400	0	0
10 „ ditto ditto	„ 1,300	0	0
8 „ ditto ditto ..	„ 900	0	0
7 „ ditto ditto .. .	„ 800	0	0
6 „ ditto ditto	„ 600	0	0
5 „ ditto ditto ...	„ 500	0	0
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"Special" Steam Pump 4" × 2"	„ 250	0	0
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A PURELY VEGETABLE SWEETMEAT, both in appearance and taste, furnishing a most agreeable method of administering the only certain remedy for INTESTINAL or THREAD WORMS. It is a perfectly safe and mild preparation, and is especially adapted for children.

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Clears the Blood from all impure Matter,
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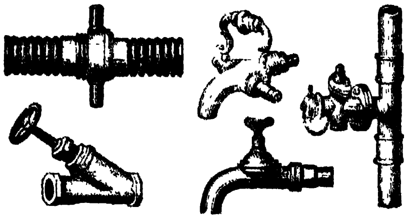

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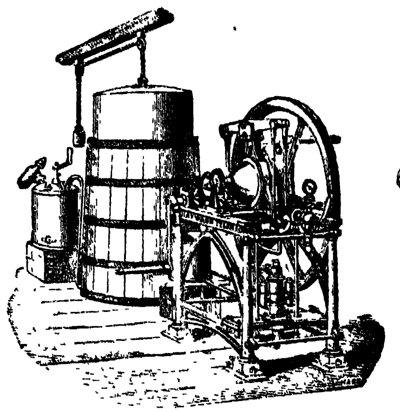

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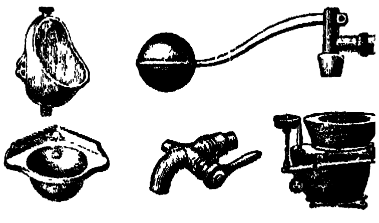

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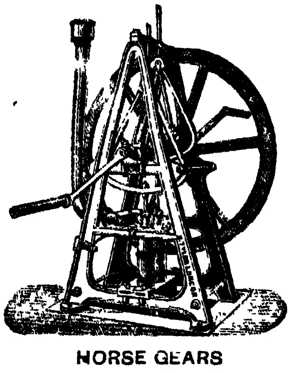

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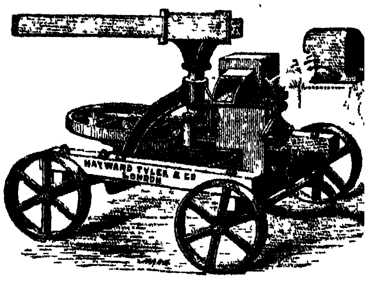

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Steam Ploughs. Horse Ploughs, Hoes, Harrows, &c.

Messrs Eastons & Anderson's
Patent Appold Centrifugal Pumps.

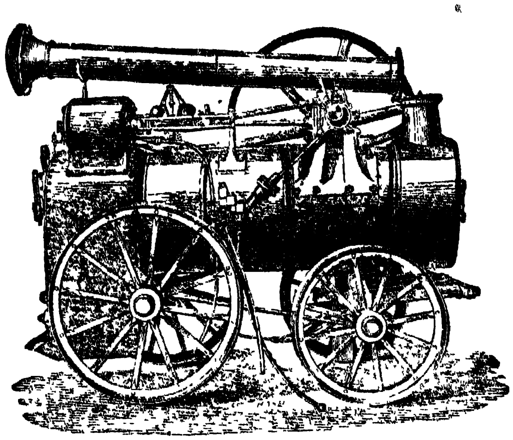
Messrs Eastbrook & Allcard's
Saw Benches, Lathes and General Engineering Machinery and Tools.

Messrs. Richmond & Chandler's
Gram Mills, Chaff Cutters, and Horse Gear.

Messrs. Warner & Son's
Fire Engines and Pumps of every description.

Messrs. Whitehead & Co.'s
Brick. Tile, and Pipe Machines, Brick Presses, &c.

Messrs. Mander Bro's
Varnish, Polish and Lacquer.



Messrs. W. & T. Avery's
Scales, Weights and Weighing Machine.

Messrs. Chubb & Son's
Safes, Locks, and Boxes.

Messrs. Wilcox & Gibb's
Sewing Machines.

Messrs. J. Tylor & Son's
Soda Water Machines.

Messrs. Smith & Wellstood's
Cooking and Heating Stoves.

Messrs. Rodger & Son's
Cutlery.

Messrs. Elkington & Co.'s & Messrs Dixon & Son's
Electro-Silver Plated Ware and Britannia Metal Ware.

Messrs. Hinks & Son's
Patent Kerosine Lamps and Hurricane Lanterns.

IMPORTERS OF

Copper, Brass, Steel, Iron, Lead, Tin, Zinc, Engineers', Carpenters', and Smiths' Tools. Files, Screws, Hinges, Nails, Bolts, Locks, Steam and Water-fittings, Brass Goods, Lamps, Lanterns, Tin-ware, Cast and Wrought Iron Enemelled Ware. Cooking Utensils in Enamelled Iron, Block Tin, and Copper. Garden Tools, Stable Fittings, Lawn Mowers, Scythes, Sickles, Filters, Baths, Boxes, Cages, &c., &c., &c., &c.

☞ *Priced Catalogues on Application.*

PHŒNIX FOUNDRY,

CALCUTTA.

THE OLDEST ENGINEERING ESTABLISHMENT IN INDIA.

JESSOP & CO.,

Civil and Mechanical Engineers, Contractors, Brass and Iron Founders, Metal Merchants, &c.

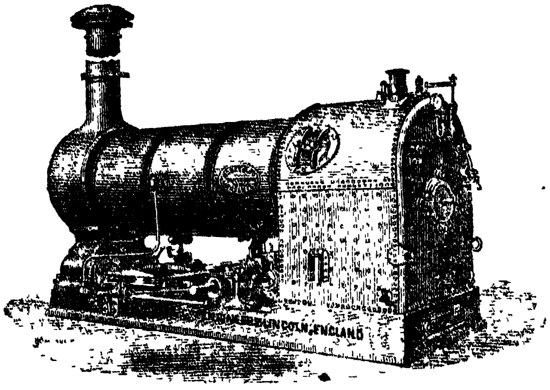
Forged and Cast Iron Work, Boilers, Machinery for Jute, Cotton and Rice Mills, Collieries, Indigo Concerns, Tea Gardens, &c., Contractors and Brick Making Plant, and every class of Iron and Brass Work made to order.

SOLE AGENTS FOR

Robey & Co.'s celebrated Portable and Fixed Engines and Machinery, Gwynne & Co.'s Centrifugal Pumps, Goulds Rotary Pumps, and Robinson's Patent Steam Traps.

Importers and Manufacturers of every description of Steam Engines and Machinery.

Portable Engines, 6, 8, 10, and 12 H.P., by Robey & Co., with enlarged Fire Boxes for burning Wood or Coal, Steam-jacketted Cylinders and all the latest improvements.



The Patent "Robey" Fixed Engine.

This Engine, for simplicity of design, ease of erection, and economy in first cost and subsequent working, is unapproached by any other Very slight foundations are required, while the brick chimney, boiler flues, and casing of the ordinary Horizontal Engine with separate Cornish Boiler are altogether saved. There is also a great saving in the cost of transit, which, in the case of the Horizontal Engine and Boiler is very great, owing to the cumbersomeness of the Boiler. The economy in fuel, as proved by actual working, is from 20 to 50 per cent., when compared with the old type of Engine doing the same work.

Horizontal and Vertical Fixed Engines, Combined Vertical Engines and Boilers on Cast-Iron Bed Plates.

Soorkey Mills, 5, 6 and 7 feet Pan.

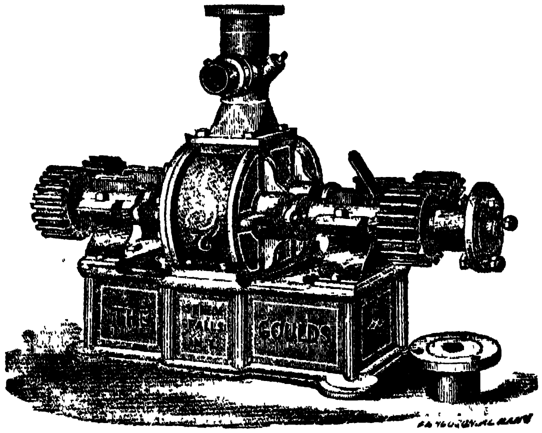
Clayton's Brick-making Machines.

Pug Mills, Brick Moulds and Stock Plates; Stoney's Patent Soorkey Screening Machines.

Drilling Machines, for Hand and Steam power: Lathe, Punching and Shearing, Screwing and Slotting Machines.

Single and Double Flour Mills.
Flour Dressing Machines.
Combined Hand Flour Mill and Dressing Machine.
Grain and Oat Crushing Machines. Chaff Cutting Machines.
Light American Ploughs
Circular Saw Benches, with Saw and set of Augers complete.
Circular Saws, up to 60 inches.
Saw Spindles with Plummer Blocks, Pulleys and Brasses complete.
Steam Hammers, Duplex Punches, and Boiler Bears.

Lift and Force Pumps in great variety, suitable for Gardens Dwelling Houses, or Irrigation



Rotary Pump, for Bullock or Steam Power.

Rotary Power Pump No. 4 has a 5-inch Suction and 4-inch Delivery Pipe, and with 150 revolutions discharges 250 Gallons per minute.

Do. Do. No. 5 has a 6-inch Suction and 5-inch Delivery Pipe, and with 200 revolutions discharges 500 Gallons per minute

Hand Rotary Pumps, to discharge 800, 900, 1,500 and 1,800 Gallons per hour.

Gwynne's Centrifugal Pumps, with Taper Pipes and Foot Valves complete.

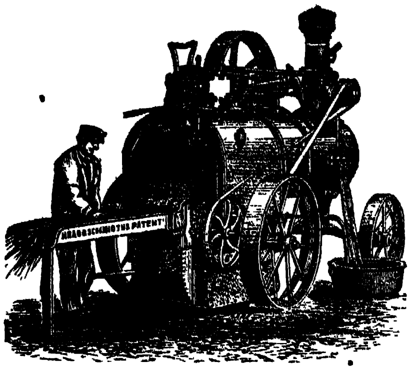
Galvanized Iron Barge Pumps, suitable for Indigo Factories.
Warner's "Noria" Chain Pumps.
Engineers' Tools and Stores of all kinds.
Tea Garden Implements and Stores.
Richard's Engine Indicators, Giffard's Injectors.
White Brothers' Portland Cement.
India Rubber and Canvas Hose.
India Rubber and Leather Belting.
India Rubber Sheeting Tucks, Patent Packing.
Indigo Screws, with Gun-metal Nuts.
Avery's Platform Weighing Machines, Salter's Spring Balances.
Heating and Cooking Stoves, the latter furnished with full sets of Cooking Utensils.
Fire-Proof Safes, with Patent Thief-proof Locks.
Spencer's Hand Drilling Machines.
Boring Tools and Rods. Proof Chains of sizes.
Blacksmiths' Anvils and Bellows. Portable Forges.
Single and Double Purchase Crab Winches.
Screw Jacks; Weston's Pulley Blocks; Stocks, Taps and Dies.

Always on hand a large stock of Plate, Bar, Angle and Tee Iron, Steel, Copper, Brass, Pig Iron, Foundry Coke, Smithy Coal, Fire Bricks and Fire Clay.

☞ *Cata[illegible]n Application.*

RANSOMES, SIMS & HEAD, IPSWICH,

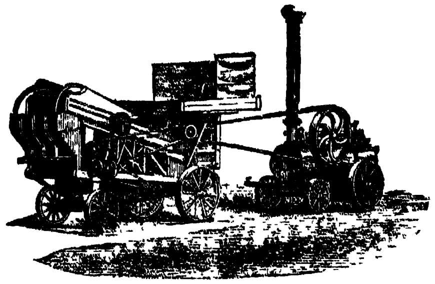
MANUFACTURERS OF
IMPROVED AGRICULTURAL MACHINERY FOR
HOT COUNTRIES.



IMPROVED PORTABLE STEAM ENGINE.

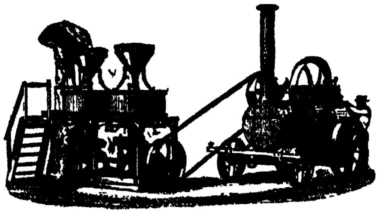
(HEAD & SCHEMIOTHS' PATENT)

For burning straw, dry grass, cotton and maize stalks, reeds and every description of dry vegetable refuse, as well as coal or wood. Economy effected in many cases £2 per diem. More than 400 in use.



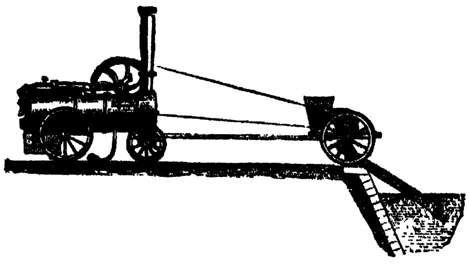
IMPROVED THRASHING MACHINE

fitted with patent apparatus for chopping and bruising the straw for food for cattle. Obviates all waste and provides a fodder perfectly free from dirt of every kind. Can be arranged to thrash any description of grain crop. The only Thrashing Machines suited for India and hot countries.



IMPROVED CORN MILL,

for wheat, barley, rye, maize, rice &c., for grinding food for cattle, or with dressing apparatus for producing household flour.



IMPROVED CENTRIFUGAL PUMP.

ESTIMATES FURNISHED ON APPLICATION,

for Pumping Machinery for various situations and requirements.

Catalogues post free on application.

Representatives in Calcutta Messrs. McNeil & Co.

Thirteen International Medals

AWARDED TO

JAMES GIBBS & COMPANY

SOLE MANUFACTURERS BY THE

PATENT

AMMONIA-FIXED GUANO

The Cheapest and best Manure in use.

ALSO MANUFACTURERS OF THE HIGHEST CLASS

CHEMICAL MANURES.

The results have given universal satisfaction and prove the Manures to be the cheapest yet sold.

FULL PARTICULARS OBTAINED ON APPLICATION

HEAD OFFICES:

16, MARK LANE, LONDON, E.C.

Branch Offices:
KING STREET HALL, BRISTOL;
42 GEORGE STREET, PLYMOUTH.

WORKS:

Victoria Docks, London; & Cattledown, Plymouth.

NICHOLLS & CO.,

EAST INDIA

FINANCIAL, GENERAL & SHIPPING AGENTS,

LONDON.
1 WHITEFRIARS STREET, FLEET STREET, E.C.
CALCUTTA
8 OLD COURT HOUSE STREET.

General Agency and Shipping Department.

Passages engaged, Goods cleared for import or export, and forwarded, Miscellaneous Purchases effected, and all Personal Agency conducted either in London or Calcutta.

Banking and Financial Agency.

FIXED DEPOSITS.

Sums received on fixed deposit subject to notice of withdrawal. Interest allowed at the following rates:—

Repayable at 6 months' notice ... ... 5 per cent.
,, at 12 months' notice ... ... 6 ,,
,, at 2 years' notice .. .. 7 ,,

Pay Bills, Pensions, and Allowances drawn, Premiums on Life Policies paid on due dates, and Bills collected.

Government Paper and Securities.

Kept in safe custody; Interest and Dividends realized on due dates, and disposed of as desired. Purchases and Sales effected at the best market rate.

Exchange.

Sterling Bills negotiated, and remittances made by Bills on our Calcutta House or by Bank Drafts. Special attention paid to family remittances, the first of Exchange, when desired, sent direct to the payee.

Charges.

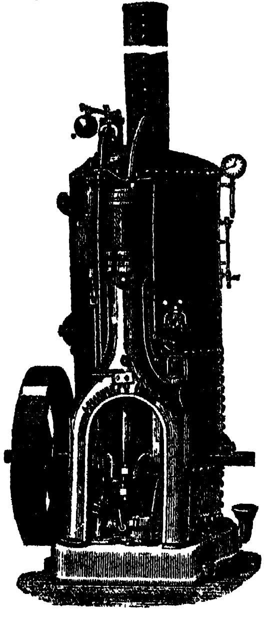
¼ per cent. on purchase or sale of Stocks, Shares, Bills, &c., on realisation of interest and dividends, and delivery of Securities out of safe custody.
1 per cent. on realisation of Pay Bills, Pensions, &c.
2½ per cent. on General Agency Business.

NICHOLLS & COMPANY,
London and Calcutta.

IMPORTANT TO

FARMERS, MANUFACTURERS, AND OTHERS REQUIRING STEAM POWER.

EXTRAORDINARY REDUCTION IN THE PRICES OF VERTICAL STEAM ENGINES AND BOILERS.



ALEXANDER SHANKS AND SON have introduced into their works SPECIAL PLANT for the Manufacture of their VERTICAL STEAM ENGINES and BOILERS, which they are now enabled to offer to the Public *at Prices so Extraordinarily Low as to defy Competition.* These Engines are made from New Designs, the whole of the details of which are finished with perfect Accuracy by Improved Machinery. The Working Parts, which are few and simple, are enclosed in a strong Cast Iron frame of one casting, which affords protection for them, and at the same time secures perfect rigidity in working. The Base-Plate can be filled with water (which becomes heated), and the Boiler Feed Pump connected to pump from it, or from any other source which may be more convenient. The Crank Shaft admits of the Fly-Wheel being placed at either side, or a Pulley of any size, to suit the work required. The very Best Materials are used in the construction of these Engines and Boilers. The latter have Cross Conical Tubes in the Fire Box, and are subjected to a Hydraulic pressure of 200 lbs. per square inch before leaving the Works. These Engines are specially recommended to Farmers, Manufacturers, and others requiring Steam Power, as the cheapest, most convenient, and economical that may be had. No expense in building Boiler in position or brick stalk is required; and, when necessary, the whole may be removed at merely the expense of cartage.

CAUTION TO INTENDING PURCHASERS.

It is essentially necessary, in comparing prices, to compare at the same time the sizes of Cylinder and Boiler per Nominal Horse Power. It will be observed that these Engines and Boilers are in this respect, considerably more powerful than many others in the market. In many cases it will be found our 2 H.P. is fully equal, in strength, measurement, and power, to some nominated 3 H.P., our 3 H.P. to others nominated 4 H.P.; and so on.

SIZES AND NOMINAL HORSE POWER OF ENGINES, WITH PRICES.

	2 *H.P.*	**3** *H.P.*	**4** *H.P.*	**5** *H.P.*	**6** *H.P.*	**8** *H.P.*	**10** *H.P.*	**12** *H.P.*
Diameter of Cylinder	[illegible] inches	5¾ inches	[illegible] inches	7¼ inches	8¼ inches	9½ inches	10½ inches	11½ inches
Length of Stroke	9 "	10 "	10 "	12 "	12 "	14 "	14 "	16 "
Diameter of Fly-Wheel... ...	2ft 11 in	3 ft. 0 in	3 ft 3 in.	5 ft 7 in.	4 ft 0 in.	4ft 9 in.	5 ft. 3 in.	6 ft 0 in.
No. of Revolutions per Min.	160	150	150	130	130	120	120	110
Height of Boiler to Crown .	5ft 5 in	6 ft, 5 in	6ft 11 in.	7 ft 5 in.	7ft. 11 in.	8ft 11 in	9 ft 11 in.	12 ft. 5 in.
Diameter of Boiler	2ft. 4 in.	2 ft 6 in.	2 ft. 9 in.	3 ft 0 in	3 ft. 3 in	3 ft. 9 in.	4 ft. 0 in.	4 ft 3 in
Number of Cross Tubes	1	1	2	2	2	3	3	4
Price of Engine and Boiler combined	£70	£80	£90	£100	£110	£150	£175	£200

ALEXANDER SHANKS & SON, Dens Iron Work, Arbroath, N.B.

AND

27 LEADENHALL STREET, LONDON.

ODAMS EXPORT MANURES,

MANUFACTURED BY THE

NITRO-PHOSPHATE

AND

ODAMS' CHEMICAL MANURE COMPANY LIMITED,

Consisting of Tenant Farmers and others occupying upwards of

200,000 Acres of Land.

CHIEF OFFICE—109, FENCHURCH STEET, LONDON.

Chairman—ROBERT LEEDS, Keswick, Old Hall, Norwich.

Managing Director.—JAMES ODAMS. | *Sub-Manager and Secretary*—C. T. MACADAM.

Several Hundred Thousand Tons of ODAMS' Manures have been manufactured, and the annually increasing demand for them is the best proof of the appreciation in which they are held. They have bee USED ON THE ROYAL FARMS for the past [illegible] years.

Export Price Lists and Particulars of [illegible] Manures for Tea Plant, &c., on application to the Secretary.

S. OWENS & CO.,

WHITEFRIARS STREET, LONDON.

HYDRAULIC ENGINEERS AND MANUFACTURERS OF

PUMPING MACHINERY OF EVERY DESCRIPTION,

FOR STEAM, WATER, WIND, CATTLE AND MANUAL POWER.

HYDRAULIC AND SCREW PRESSES, OIL MILL MACHINERY, HYDRAULIC LIFTS, &c.

SOLE MAKERS FOR GREAT BRITAIN OF

BLAKE'S PATENT DIRECT-ACTING STEAM-PUMP, MORE THAN 10,000 IN USE.

The following are some of the prominent advantages of the Blake Pump.—

It will start at any point of stroke.

It has no dead point.

It works fast or slow, with the same certainty of action.

It is economical. Has a lead on the Slide Valve.

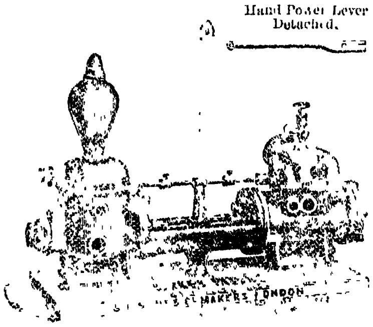
It is compact and durable.

It is interchangeable in all its working parts.

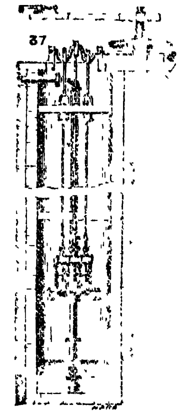
It will deliver more water than any other Pump.

It is made of best materials in the most workmanlike manner.

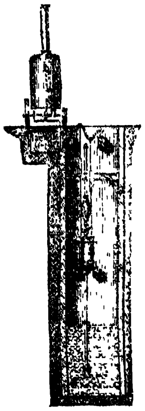
Can be worked at 20 strokes per hour or 200 strokes per minute.



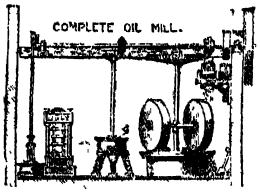
BLAKE'S PATENT
Direct-Acting Steam Pump and Boiler Feeder.



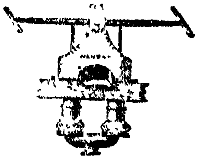
Deep well Pumps, for Horse or Bullock power.



Vertical Combined Steam Engine, Boiler, and Deep-well Pumps.


COMPLETE OIL MILL.

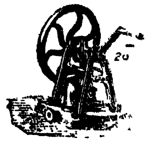
Oil Mills, for Steam or Cattle Power.



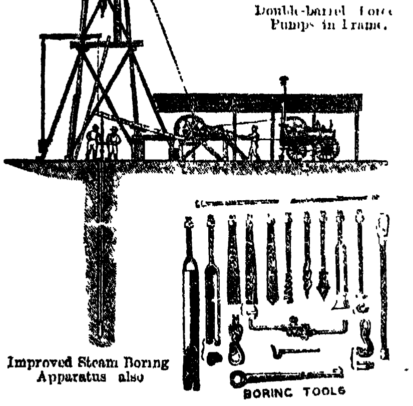
Double-barrel Contractors' Pumps, for hand or steam power.

Double barrel Fire Engine, for Mansions, Factories, &c.

Deep Well Pump for Hand Power.

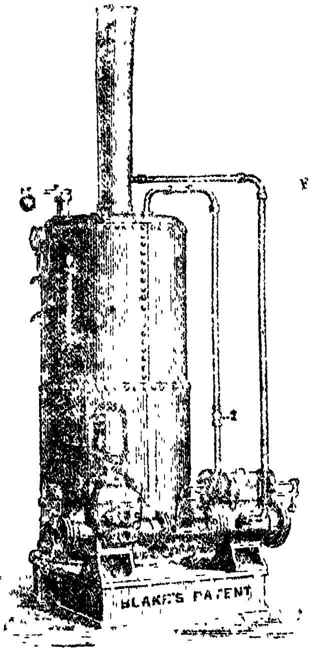


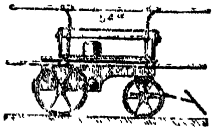
Double-barrel Force Pumps in Frame.



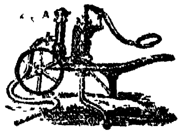
Improved Steam Boring Apparatus also

Boring Tools of every description, for Artesian Wells, testing for Minerals, Foundations, &c.



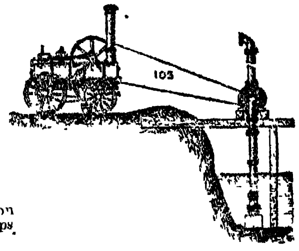


Fire Engines, for Towns, Railway Stations, &c.



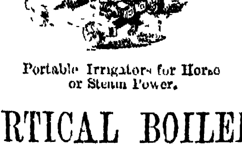
Force Pumps on Barrow.

Wrought Iron Portable Pumps.



Patent Centrifugal Pumps, for Contractors' use, or Irrigation work.

Cast Iron House or Garden Pump



Portable Irrigators for Horse or Steam Power.

BLAKE'S PATENT DIRECT-ACTING STEAM PUMP AND VERTICAL BOILER

FOR IRRIGATION PURPOSES,

FILLING TANKS, WATER SUPPLY TO PLANTATIONS, SMALL TOWNS OR VILLAGES.

WHITEFRIARS IRONWORKS, WHITEFRIARS ST., FLEET STREET, LONDON.

CATALOGUES AND ESTIMATES FREE ON APPLICATION.

The Indian Tea Agency Limited.

TEAS
OF
ASSAM
CACHAR & SYLHET
CHITTAGONG
DARJEELING

TEAS
OF
KANGRA
KUMAON
DEHRA DHOON
THE
NEILGHERRIES

CEYLON AND SINGAPORE.

LONDON:—2, JERMYN ST., ST. JAMES', S.W.;
5, EAST INDIA AVENUE, E.C.

AGENTS:
CALCUTTA: MESSRS. NICHOLLS & CO.; 8, OLD COURT HOUSE STREET.

THE INDIAN TEA AGENCY LIMITED,

Has been established to supply DIRECT TO THE PUBLIC *every kind of* PURE TEA FROM ALL THE TEA-GROWING DISTRICTS OF INDIA.

The Agency is not interested in any single Plantation, or the produce of any particular district. Though numbering among its Shareholders gentlemen largely interested in all the Tea-producing districts of India, the administration of the Company is tied to none, and the business is conducted solely with the object of introducing the best Indian Teas to the public, wherever grown. Our purchases are made at the Plantations, at the Calcutta sales, or in Mincing Lane, as may be most advantageous, and FOR CASH, to be sold FOR CASH, at the most moderate possible profit consistent with quality, and an absolute guarantee of purity, strength, and flavour.

THE TEAS are sold as follows:

1.—Our own STANDARD MIXTURES blended from the produce of the best plantations in India.

2.—DISTRICT BLENDS to suit the tastes of those who have been accustomed to or prefer Tea from any of the Indian Tea-growing districts, viz:—

ASSAM, CACHAR, SYLHET, DARJEELING, KANGRA, DEHRA DHOON, KUMAON, CHITTAGONG,
THE NEILGHERRIES, CEYLON AND SINGAPORE.

3.—UNMIXED TEA from the leading plantations as imported. We have made arrangements with the principal Tea Planters to keep a stock of their Teas for this purpose, and generally can undertake to procure the Tea of any special plantation.

THE PRICES have been fixed on the most moderate scale for Cash. For Nos. 1 and 2 (our own and the District Blends), the prices run from 2s. to 6s per lb., according to quality. For No. 3, the pri[illegible] somewhat higher, to cover the extra cost and trouble of keeping them in stock, in so many varieties. See Price List.

All Tea of and above 3lbs. will be carefully packed in tin canisters *(without extra charge)*, to preserve its freshness and full aroma, and delivered free in London, and the Surburban districts. Purchases of £2 and upwards free to any Railway Station. Sold also in packets of 1 lb., ½ lb. and ¼ lb

LONDON: 2, JERMYN STREET, S.W. A. BURRELL, *Managing Director.*